RECORDS

OF THE

CANTERBURY MUSEUM.

Vol. I. No. 2.

Published by authority of the Board of Governors.

EDGAR R. WAITE, F.L.S., Curator.

CHRISTCHURCH, NEW ZEALAND.

13th July, 1909.

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CANTERBURY COLLEGE

(University of New Zealand).

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CHRISTCHURCH, NEW ZEALAND.
1907-1912.

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PREFATORY.

As the following introduction is written in a more popular manner than is usual in scientific publications, and as it deals with matter of local rather than of general interest, some explanation may be advisable.

The expedition was undertaken by the New Zealand Government purely in the interests of the fishing industry, and all specimens gathered, with the exception of the food-fishes, were, by those responsible for the conduct of the expedition, regarded as by-products.

The object of the present publication is to record the results of the scientific examination of all specimens preserved, and the preparation of the several reports has been kindly undertaken by specialists in their respective subjects.

As, however, the Government is, at the instance of the Hon. the Minister of Marine, financially assisting the publication of the results, and as the report therefore partakes of the nature of an official production, something more than a purely scientific treatise is naturally expected.

While, therefore, the special articles are devoted to a record of the scientific results of the expedition, details of the cruise and the historical or otherwise extraneous matter is assigned to the introduction. This will also explain why much apparently appropriate to the report on the fishes appears in the introductory portion.

After the introduction was written, an interim report was published by the Government, and this is also referred to.

E. R. W.

Canterbury Museum, October, 1908.

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Scientific Results

of the

New Zealand Government

Trawling Expedition,

1907.

Edited by EDGAR R. WAITE, F.L.S.,
Curator.

WELLINGTON:
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NOTE.

As this number is being printed by the Government, and issued simultaneously as an official publication, it is uniform with other Government pamphlets, and not with the preceding number of the "Records of the Canterbury Museum."

SCIENTIFIC RESULTS

OF THE

NEW ZEALAND GOVERNMENT TRAWLING EXPEDITION, 1907.

INTRODUCTION.

By EDGAR R. WAITE, F.L.S.

Plates I–VI and Chart.*

IN my introduction to the "Scientific Results of the Trawling Expedition of H.M.C.S. 'Thetis' off the Coast of New South Wales in 1898"† I gave some account of the various scientific expeditions which had visited the colony, or had been locally organized.

A similar work has since been done for New Zealand, for in 1904 the late Captain F. W. Hutton, F.R.S., published an admirable *résumé* in the introduction to the "Index Faunæ Novæ-Zealandiæ."‡ The work of local naturalists published in the "Transactions of the New Zealand Institute" is referred to, as are also sundry descriptive catalogues.

PREVIOUS EXPEDITIONS.

No mention is made in the "Index" of two Government trawling expeditions which took place in 1900 and 1901 respectively. As these are the only investigations of the nature which have been undertaken in New Zealand, and as they naturally lead up to the trawling expedition of the "Nora Niven," some account of them is here supplied, culled mainly from the official reports.§

* For explanation of plates see p. 63.

† Waite. Mem. Aust. Mus., iv, 1899.

‡ Hutton. Index Faunæ Novæ-Zealandiæ, 1904.

§ Ayson. Reports, Experimental Trawling, 1900 and 1901.

Commercial trawling has been prosecuted in New Zealand waters for a number of years, the principal centres being Napier, Lyttelton, and Dunedin.

With the object of assisting and furthering the fishing industry, the New Zealand Government has on three occasions organized and carried out an extensive series of experimental trawling investigations, the objects, as detailed in the official reports, being "to ascertain what extent of trawling-grounds existed, what varieties of marketable fish were obtainable in the different localities; to prove whether the conditions necessary for carrying on successful trawling existed in certain localities within workable distance of the best markets, and, if so, to place the information on record for the guidance of those interested in the trawling industry; and generally to acquire information on the distribution of food-fishes, &c., in the sea surrounding these islands."

The first expedition was undertaken in the "Doto," a small steam-trawler of 28 tons, and extended from the 10th March to the 7th June, 1900. One hundred and fifty-four hauls of the net were made, at depths ranging from $2\frac{1}{2}$ to 50 fathoms. The operations extended from Stewart Island and Foveaux Strait in the south, up the east coast of the South Island to Cook Strait. Hauls were also made in Tasman Bay and South Taranaki Bight.

As this left the waters of the North Island scarcely touched, a second expedition was undertaken in the following year. This was, however, really a continuation of the previous essay, and was confined to the coastal waters of the North Island. The "Doto" was again chartered, and operated from the 9th February to the 2nd May, 1901, from which latter date, until the 20th May, the trawler "Rita" replaced the "Doto." During this cruise 122 hauls were made, between the extremes of 3 and 38 fathoms.

For purposes of the present review the two expeditions may be taken together, and, in case of necessary reference to the respective reports, the dates 1900 and 1901 will sufficiently indicate them.

These reports were written by Mr. L. F. Ayson, Chief Inspector of Fisheries for New Zealand, who was in charge of the investigations, and superintended the operations throughout.

The Government recognised, on the representation of Mr. Ayson, the desirability of having on board some one acquainted with the fishes from a more technical standpoint than that of the commercial fisherman—some one who could specifically identify the catches, instead of merely enumerating them as "sharks," "flounders," &c.

It was not found possible to obtain the services of a recognised ichthyologist for the whole period of the cruise, but at different times Professor W. B. Benham and Messrs. A. Hamilton and G. M. Thomson accompanied the vessel, and supplied preliminary notices, which are printed as appendices to the official reports.

A list of the marketable and otherwise well-known fishes was supplied with each report by Mr. Ayson. Mr. A. Hamilton undertook the examination of the remainder of the fishes preserved on the first expedition, eighteen in number. One of these was recognised as a new species under the name of *Astrape aysoni*, the genus also being an addition to the New Zealand fauna. In this instance only does the specific locality appear to have been recorded.

In printing the list of fishes supplied by Mr. Hamilton, the editor of the report overlooked the fact that, of the species characterized as being additional, four appear in Mr. Ayson's report: these are *Myliobatis aquila*, *Monacanthus convexirostris*, *Chelidonichthys* (*Trigla*) *kumu*, and *Sebastes percoides*.

Very few zoological specimens appear to have been preserved from the takings of the second expedition: all were handed to Professor Benham. Of the fishes he writes, "Amongst the half-dozen of small fish, one, *Scorpæna plebeia*, is a rarity."

Though, as before mentioned, a depth of 50 fathoms was reached by the trawl, this occurred once only. On four other occasions 40 fathoms was touched or exceeded. The following analysis of figures supplied in the reports shows that, generally speaking, operations were conducted in comparatively shallow water, for, while on 255 occasions the trawl operated in 20 fathoms or under, the number of times 20 fathoms was exceeded was sixty-six only. The table indicates the figures for each 10 fathoms:—

	Fathoms.				
	0–10.	11–20.	21–30.	31–40.	41–50.
Hauls, 1900	71	74	15	5	5
Hauls, 1901	52	58	34	7	0
Totals	123	132	49	12	5

THE "NORA NIVEN" EXPEDITION.

It being realised that the deeper waters had not been investigated, a third expedition was organized, advantage being taken of the following circumstance: The Napier Fish-supply Company, having decided to add to their fleet a larger and more powerful vessel, commissioned a Grimsby shipbuilding firm to construct a new trawler suited to their requirements. The Government made arrangements with the company, and as soon as the vessel arrived and was fitted for work she was chartered for three months.

The "Nora Niven," as the trawler was named, is much larger than the "Doto," better adapted for rough weather and prolonged steaming, and is fitted with modern gear, built for powerful haulage. The vessel, which is described as being the largest and most up-to-date trawler which has been seen in Australasian waters,* attracted considerable attention at the various ports of call, and is thus described in the local press :—

"The 'Nora Niven' was built in Selby, and is constructed of steel. She is 96 ft. long, the net register being 56 tons. In ordinary weather she can steam 8½ knots an hour. Among the notable features of the trawler is a complete ice-making plant, capable of turning out about 2 tons of ice every twenty-four hours. There is also an acetylene-gas lighting plant, and the winch for working the trawl is an exceedingly powerful one. The vessel has cost to date £10,600, including £1,400 to equip her with refrigerating machinery."

As on previous occasions, Mr. Ayson was anxious to secure the services of an ichthyologist, and, knowing my interest in the subject, and my association with similar undertakings in New South Wales, recommended that I should be commissioned to undertake the scientific work of the expedition.

Doubtless owing to failure to appreciate the advisability, at least, of the course suggested, the recommendation was not adopted by the Government. By the courtesy of the Hon. J. A. Millar, Minister of Marine, I was invited to accompany the expedition in my capacity as curator of the Canterbury Museum; and I desire to record my thanks for his kindness, also my appreciation of the consideration and sympathetic interest shown by the Chairman and Board of Governors of Canterbury College in permitting my absence from Museum duty for so long a period, especially as it became necessary to appoint a *locum tenens*.

It was, however, only my keen desire to embrace the opportunity afforded for collecting and studying the marine fishes of the Dominion which decided me to accept a passage on the unsatisfactory terms above indicated—namely, those incidental to my being but a guest on board.

During the period of the investigations, any barrier which might have existed in connection with my unofficial association with the expedition was largely removed by Mr. Ayson, for he assisted my work in every possible way.

EQUIPMENT.

Though the expedition was fitted with several scientific appliances, such as sets of thermometers, sounding-apparatus, &c., all of which were regularly and systematically used, the provision for actual trawling was of the ordinary commercial type, designed only to arrest the

* The new Commonwealth trawler "Endeavour," commissioned since the above was written, is probably larger.

larger or marketable fishes. No effort or arrangement was made to secure the smaller species or invertebrates, the presence or absence of which may have an important bearing on the distribution of the economic fishes.

I endeavoured to remedy this omission to a certain extent by obtaining permission to introduce, within the trawl, sections of a smaller-meshed cotton net, the only kind procurable at short notice. This, however, soon went to pieces, and, as some trouble was entailed in fixing a new section, it was only occasionally that the net was introduced for me. When, however, this small net was used, the increased number of species obtained was very marked. I especially regret that, though the trawl was hauled on several occasions in the waters surrounding the Chatham Islands, the small net was not once employed.

Tow-nets were freely used, but I am sorry to have to state that nearly all the takings were washed overboard during heavy weather.

While dealing with the subject of equipment, I may mention that I placed on board various dredges, &c., but had little opportunity of using them. Some dredgings in 100 fathoms or over were conducted on behalf of the Australasian Association for the Advancement of Science, at the instance of its Committee for the Biological and Hydrographical Study of the New Zealand Coast (of which I am a member). The committee placed the necessary apparatus and equipment at my disposal, and, out of five essays, four proved successful. The results of the hauls will be communicated after the material has been investigated; the samples of the bottom obtained having been placed in the hands of Mr. Suter, of Auckland, for report. The following are details of the four successful stations.

Bucket-dredge Stations.

Station.	Date.	Position.	Fathoms.
A ..	June 19 ..	24 miles S.E. of Long Point ..	120
B ..	,, 24 ..	12 miles S.E. of Cape Saunders	100
C ..	July 11 ..	60 miles E. of Lyttelton ..	100
D ..	Aug. 13 ..	20 miles N.E. of Flat Rock ..	105

Scientific Observations.

Mr. L. F. Ayson, who is a member of the Committee of the Australasian Association for the Advancement of Science on Sea-surface Temperatures, has kindly allowed me the use of the observations taken on board the trawler, and the following is a complete record. When Mr. Ayson was, owing to illness, compelled to relinquish control of the expedition, the records of observations were continued by Mr. Thomas Anderton, his successor.

The marine temperatures were taken with the Casella self-recording thermometer.

Date.	Wind.		Barometer.	Temperature.			Fathoms.
	Direction.	Force (0–10).		Air.	Sea.		
					Surface.	Bottom.	
1907.							
June 10 ..	W. ..	6	30·0	..	51·0	52·0	..
,, 11 ..	S.W.	4	29·9	..	51·0	51·0	54
,, 12 ..	S.W.	4	29·8	..	51·0	51·2	37
,, 13 ..	S.W.	4	29·8	54·0	51·5	52·0	65
,, 18 ..	E. ..	3	30·0	48·0	53·0	52·0	26
,, 19 ..	E. ..	2	30·2	47·0	51·0	49·0	43
,, 20 ..	W. ..	2	30·35	42·0	50·0	45·0	50
,, 21 ..	W. ..	4	30·4	46·0	50·5	46·0	20
,, 22 ..	S.W.	4	30·2	53·0	51·0	48·8	27
,, 24 ..	S.W.	6	30·15	50·0	50·0	48·0	44
,, 25 ..	W. ..	1	30·1	49·0	51·0	48·0	55
July 1 ..	S. ..	1	29·9	54·0	49·0	48·2	20
,, 2 ..	N. ..	3	29·6	49·0	49·0	49·3	20
,, 3 ..	N. ..	1	29·66	54·0	50·0	50·3	19
,, 4 ..	N. ..	1	29·68	48·0	49·0	49·0	13
,, 5 ..	N.N.E.	4	29·9	52·0	50·0	49·0	35
,, 6 ..	Calm	..	29·7	50·0	46·0	48·0	28
,, 9 ..	S.S.E.	7	29·72	..	48·0	49·3	21
,, 10 ..	S. ..	8	29·9	..	46·0	48·1	10
,, 11 ..	N. ..	2	29·4	52·0	52·0	49·4	24
,, 12 ..	Calm	..	..	..	48·0	49·3	50
,, 18 ..	E. ..	1	30·52	52·0	50·0	..	38
,, 19 ..	N.W.	1	30·42	50·0	48·0	49·25	10
Aug. 12 ..	E.S.E.	1	29·9	54·0	50·0	50·28	28
,, 13 ..	N.W.	2	29·72	48·0	49·0	50·23	14
,, 14 ..	S.W.	5	29·6	56·0	54·0	..	28
,, 15 ..	N.W.	1	29·7	56·0	55·0	..	24
,, 19 ..	W.S.W.	5	29·7	56·0	55·0	..	68
,, 22 ..	S.W.	2	30·0	58·0	57·0	58·0	105
,, 23 ..	S.W.	3	29·5	56·0	57·0	57·0	57

Accommodation.

Owing to the absorption of all suitable space on board by the net and trawling appliances, my gear had to be placed on deck. On two occasions I lost heavy collecting-tanks well charged with selected specimens, for they broke away from the lashings and were cast overboard.

With the object of providing accommodation for me, Mr. Ayson very considerately cleared a space in the net-store, below deck; but, in the absence of suitable rackwork fixtures, the liveliness of the vessel rendered the situation impossible and even dangerous. Accidents happening while attempting to convey bottles, &c., up or down an iron ladder, normally vertical, and resulting in broken bottles and scattered contents, to say nothing of bruised limbs, decided me to resume my occupation on deck.

Itinerary of the Cruise.

The vessel left Wellington on the 5th June, 1907, and on the day following called at Lyttelton, where I went aboard. We made a southerly course, but, meeting with heavy seas, anchored in Half-moon Bay, Stewart Island, on the evening of the 8th. Several whales were passed on the way, and shoals of penguins (probably *Catarrhactes pachyrhynchus* and *C. chrysocome*) were encountered.

We left shelter on several occasions, returning successively to Port Adventure and Paterson's Inlet, but the sea was too rough to permit us to do more than take soundings, and it was not until the 11th June that the trawl was first lowered. On the 13th, when fifty miles east of Wreck Reef, we passed suddenly over a shelf, the soundings within two miles deepening from 65 to 183 fathoms. As the trawl-warps were nearly run out, we put about, and, steaming nearly two miles, hauled in 67 fathoms.

We finally left Stewart Island (Paterson's Inlet) on the 15th June in a snowstorm, and experienced tremendous seas to Ruapuke Island, thence to the Bluff. On the 18th a course was shaped along the south-east coast of the South Island, hauls being made daily to the 22nd June, and on the 24th and 25th, on which latter date we entered Otago Heads.

On the 19th June the first trial was made with the deep-sea dredge, twenty-four miles south-east of Long Point, in 120 fathoms (Station A), with satisfactory result.

When trawling this section, numbers of mollymawks (*Diomedea melanophrys* and *D. chlororhynchus*) were in close attendance, feeding at the side of the vessel, and devouring the food thrown to them. They are capable of swallowing a full-sized red-cod (*Physiculus bachus*) whole. When one of the birds had the "field" to itself it would pick the fish to pieces as it floated on the water, but, if another bird approached, the fish was quickly gulped down. On the 24th June the dredge was lowered twelve miles south-east of Cape Saunders, in 100 fathoms (Station B), and samples of the bottom obtained.

At Dunedin Mr. Ayson sought medical advice, and as a result most unwillingly relinquished his active connection with the expedition, to the regret of all on board.

On the last day of June we left Port Chalmers, with Mr. Thomas Anderton, Director of the Portobello Marine Fish Hatchery, in charge,

and during the anchorage in Blueskin Bay fishing-lines were put over. When the bait was below the sinker we got examples of dog-fish (*Squalus fernandinus*)* only when above, red-cod (*Physiculus bachus*). The latter bore parasitic copepods in their gill-cavities. Dr. Chilton has identified them as *Chondracanthus lotellæ* G. M. Thomson.

From the 1st to the 12th of July, the 7th excepted, hauls were made daily, fifty stations being charted to date, by which time we had worked the ground northward to Lyttelton Harbour. On this section I got eggs of *Cephaloscyllium laticeps*, previously unknown, and noted that almost every adult *Pinna* taken had its crustacean commensal, *Pinnotheres*. Here also happened the incident with the blind eel, detailed in the account of *Eptatretus forsteri*. On the night of the 9th July we encountered a southerly gale, and I was twice tossed out of my bunk. When morning broke I found nearly all my gear on deck adrift; one large tank had vanished overboard, others were smashed, and the deck was littered with specimens not carried over the bulwarks or washed through the scuppers. Details of all the fishes taken at the various stations had been carefully chronicled. Accompanying labels being solely relied upon in respect to the invertebrates, it is more than probable that the zoologists who are kindly examining the lower orders of animals taken will find some confusion in the records. Only one haul (Station 45) was made on the 10th, under shelter of the northern coast of Banks Peninsula. On the following day the dredge was lowered in 100 fathoms, sixty miles to the eastward (Station C).

Twelve hauls (Stations 52–63) were made between the 15th July (on which date we sailed from Lyttelton) and the 19th (whereon Wellington was reached).

At Stations 55 and 56 thick sticky green mud or clay was encountered, twenty to twenty-four miles east of Motunau Island. At the 55th station we were operating the port net, and on reaching the 40-fathoms line the whole of the "belly" and cod end were dragged out. The starboard net, a new one, was next used, and put over in deeper water—55 fathoms—but when 58 fathoms was reached serious trouble ensued. When the net was hauled to the surface it was found to contain an enormous weight of sticky clay, and, without warning, the whole net went to pieces, little but the head and ground ropes being left attached to the otter-boards. The otters themselves had been half-buried in the clay, masses of which still adhered to them. This dangerous area should be carefully surveyed and charted for the benefit of trawlers.

Owing to a variety of circumstances, the waters to the northward of Wellington were not investigated at this stage. We left the

* Mr. Tate Regan considers (Ann. Mag. Nat. Hist., Ser. 8, ii, 1908, p. 46) that the New Zealand form, identified with *S. acanthias*, is referable to this southern species.

capital on the 20th July, and reached Napier on the 22nd, after a very rough passage, which occupied eighteen hours longer than was anticipated. During this experience I lost a collecting-tank and its contents, and had one of my photographic cameras destroyed.

While at Napier on this and the subsequent visit I was the guest of Messrs. J. J. Niven and Butcher, owners of the trawler, and take this opportunity of recording my appreciation of the kind manner in which they received me.

I am also indebted to Mr. Niven for providing me with a small collection of fishes trawled in the vicinity of Hawke's Bay, principally pleuronectids. These will be useful when the family is under examination.

Napier was left on the 25th July, and on the afternoon of the 28th we anchored in Waitangi Bay, Chatham Islands. During our stay Stations 64 to 70 were charted, but time was principally spent in line-fishing, it being intended to secure a large quantity of fish for the Wellington market—an expectation amply fulfilled. Large catches of hapuku (*Polyprion prognathus*) and blue-cod (*Parapercis colias*) were made from the boats, and moki (*Latris ciliaris*), terakihi (*Cheilodactylus macropterus*), and other fishes were taken in set-nets.

Pitt Island was also visited, and similarly satisfactory catches were made, the blue-cod attaining a weight of 9 lb. Some of the island fishermen were engaged to assist in filling the cold-chamber.

The lines were set with three hooks each, and it was a common occurrence to haul up three fishes at once, generally blue-cod. Though I obtained the heaviest fish (62 lb.) taken during our visit, a member of the crew secured three smaller hapuku on his line at one time. On all other occasions a blue-cod had taken the third hook.

Enormous bags of swimming-crabs (*Platyonichus bipustulatus*) and crayfish (*Jasus edwardsi*) were taken in Petre and Hanson Bays.

Mr. Reuben Cannon, of Whangaroa, described to me a large red fish, numbers of which had been cast on to Topenga Bay, on the northern coast of Chatham Island, and from his description I had not the slightest doubt that he referred to the opah (*Lampris retsius*). As there was a chance of specimens or their remains being still on the beach, Mr. Cannon kindly furnished me with a horse, and himself acted as guide, the route traversed being across dangerous bogs and treacherous watercourses. Our quest was unsuccessful, and after a ride of eighteen miles we reached Mr. Cannon's house, where I became his guest for the night, riding to Port Hutt next morning. Since returning to Christchurch I have seen a photograph of the fish, taken by Mr. Cannon's brother, and it represents, as I had suspected, the opah. It is interesting to learn that several examples of this rare fish had been on the beach at the same time.

Some individuals of the cattle on the island develop a taste for seaweed, and prefer it to grass. We saw several feeding on the shore, all miserably thin, which, Mr. Cannon informs me, is a characteristic

of cattle taking to this strange diet, and from which they cannot be weaned.

Leaving the island on the 7th August, Wellington was reached on the 10th, and on the 12th we commenced our northern cruise. On the evening of the following day some lantern-fishes (myctophids) were washed aboard. Parasitic copepods taken from red-cod obtained at Station 75 are identified by Dr. Chilton with *Lernea lotellæ* G. M. Thomson. The dredge, lowered in 105 fathoms, twenty miles north-east of Flat Point (Station D), was hauled aboard full of green mud. On our passage to Napier, reached on the 16th August, we were almost continuously accompanied by porpoises. A school would sight us a mile or more distant, and head straight for the vessel, when the individuals would zigzag from side to side across the bows, revelling in the foam which our passage produced. (Plate VI, fig. 2).

We shot a couple of the mammals with a military rifle, and put the ship about to where the ruddy water showed they had been killed, but the bodies had sunk. Our engineer later harpooned one of the porpoises, and we hauled it on deck. An examination showed it to be *Lagenorhynchus obscurus* Gray. Our captain, who is familiar with the coast, told me that he has never seen the species far from land, and that it is known to the local sailors as the " sand-porpoise."

Having made a dozen hauls since the 12th we reached Napier on the 16th August, leaving again on the 19th. Rough weather interfered with our programme, and sections of the coast were skipped in the hope that calmer conditions would prevail on return from Auckland. The Bay of Plenty therefore received most attention, and here we trawled several species not before taken.

Large hauls of schnapper (*Pagrosomus auratus*) were made, and so great was their buoyancy when drawn from deep water that they not only brought the net and its contents to the surface, but, in addition, supported the weight of Mr. Alward, our chief engineer, who jumped boldly on to the net. It was some time before the fish slipped away from under his feet sufficiently to sink him to the chest, and in this situation I photographed him (Plate VI, fig. 1). Had a plank been placed across the net, I am confident that three men would have been supported. Terakihi were also buoyant, but in this respect no fish equalled the ling (*Genypterus blacodes*), taken chiefly at our southern stations. Normally full-bodied, when the air-bladder and tissues were distended it resembled an elongated barrel, and comparatively few were required in the net to bring the whole to the surface.

At Station 96 (24th August) we trawled the greatest weight of fish taken : the bag, estimated to weigh nearly 2 tons, consisted almost entirely of schnapper and terakihi.

On the following day, while near White Island, the marine volcano, the feed-pump broke down, and we headed for Auckland, arriving on the 26th August. Here I parted company with the " Nora Niven " and returned to Christchurch *via* New Plym th.

The trawler made a few more hauls on her return to Wellington, and some fishes were preserved for me by Mr. Anderton. These prove to be of considerable interest, and will be dealt with in their proper position in the systematic portion of the report.

As above indicated, ninety-six hauls were made to the time Auckland was reached, and the following table shows the relative frequency of the trials at the different depths enumerated :—

Fathoms ..	0–10	11–20	21–30	31–40	41–50	51–60	61–70
Hauls . ..	7	32	45	28	21	13	8

Fathoms ..	71–80	81–90	91–100	101 and over.
Hauls	6	3	2	2

Collection and Examination of Results.

Being my own special care, and the only members of the marine fauna with which the expedition was officially concerned, the fishes naturally received the greatest attention.

I am satisfied that of all the fishes brought on deck, not a single species escaped record at any of the ninety-six stations with which I was associated. Had better provision been made for the retention of the smaller specimens and species, many more would certainly have to be recorded. This is no mere opinion, for on several occasions I skimmed off the surface of the water, by means of a hand-net, small fishes which had escaped through the meshes and were not represented in the collection emptied on the deck. One little fish obtained in this way was the only specimen of the species taken during the cruise. When the net was being gathered together at the vessel's side, preparatory to being hoisted on deck, my usual occupation was the wielding of the hand-net, for the trawl was frequently surrounded by small fishes which had escaped through its large meshes.

Considerable time was absorbed in examining the mass and passing under review every individual fish obtained ; then a selection had to be made for future study, and put aside for preparation and preservation.

It is not my present object to write of the economic results of the expedition ; such will doubtless be dealt with in the official reports. Lest, however, my silence be construed as unfavourable, I may say that I am much impressed with the plenitude of edible fishes to be obtained from certain areas.

It was not possible to attempt any serious enumeration of the invertebrata, the larger and, to me, familiar forms only being recorded ; for the rest, as many were collected as possible, and preserved for the benefit of specialists in the several groups.

It is possible that when the invertebrata are studied some interesting species may be found, but it will be understood that the material I have been able to place in other hands is but a portion of that trawled, and, of course, a mere tithe of what could have been taken had suitable appliances been provided, and had the necessary assistance been available.

I know of no other profession in which study and time are so freely and gratuitously rendered, for pure love of research, as that of the biologist, and my best thanks are due, and are hereby gratefully tendered, to those who have so kindly assisted me with reports on their respective subjects.

The full list of contributors is as follows :—

Algæ—R. M. Laing, M.A., B.Sc.
Annelida
Siphunculoidea } Professor W. B. Benham, M.A., D.Sc., F.R.S.
Echinoderma
Mollusca, &c.—Henry Suter.
Nudibranchia—Sir Charles Eliot, K.C.M.G., LL.D.
Cephalopoda—W. E. Hoyle, M.A., D.Sc.
Crustacea—Professor Charles Chilton, M.A., D.Sc., M.B., C.M., F.L.S.
Pisces—Edgar R. Waite, F.L.S.

Official Report.

On the 23rd April, 1908, after the foregoing had been passed in for publication, I received, by courtesy of Mr. Ayson, a copy of the official report, doubtless issued a few days previously.*

This, though styled an "interim report," is very detailed and exhaustive as far as trawling is concerned, and contains interesting *data*, some few particulars of which may be referred to here.

The total weight of marketable fish brought to port by the trawler during the three-months cruise was 46,750 lb. 2,743 blue-cod (*Parapercis colias*) were taken at the Chatham Islands on hand-lines. Mr. Anderton (who supplied the report on the operations at the Chatham Islands) writes, "It was a sight to see the boats returning after a couple of hours' fishing, loaded to the gunwale with blue-cod. Four Pitt-Islanders caught 230 of the largest blue-cod I have ever seen in less than an hour and a half's fishing off the north-west corner of Pitt Island. Six of the crew caught 606 blue-cod and 103 large hapuku (*Polyprion prognathus*) in seven hours off Whangaroa, and on another occasion caught 860 blue-cod in three hours and a half. Almost all the men were inexperienced in the art of blue-cod fishing, making the catch all the more remarkable. It is extremely probable that the Chatham Islands will in the near future become one of the most important sources of our fish-supply." I fully agree with Mr. Ander-

* Ayson. Interim Report, Experimental Trawling, 1907.

ton's remarks, and consider that with the great demand for blue-cod in New Zealand and Australia, and the prodigious supply to be won around the Chathams and neighbouring islets, a very profitable industry could be maintained. Further, it might be hoped that the establishment of such an industry would materially reduce the price of fish, which in New Zealand is an expensive luxury, and not, as it should be in our island community, a cheap and common article of wholesome food.

One of the appendices to the report tabulates the number of each kind of marketable fish taken in the trawl. In point of quantity the following are the most important: Of schnapper (*Pagrosomus auratus*), taken only off the North Island, 8,540 were obtained, the vast majority being secured in the Bay of Plenty. One haul (Station 96) yielded 1,178, another (Station 106) 1,200, and at three hauls (Stations 102–104) 2,250 were netted. These five hauls also produced the largest relative quantity of terakihi (*Cheilodactylus macropterus*), the figures respectively being 720, 1,000, and 1,650. Though taken most numerously in the Bay of Plenty, this species was very generally obtained during the whole cruise, and is without doubt the most ubiquitous food-fish on the New Zealand coast: the total number of examples prepared for market being 8,273. Red-cod (*Physiculus bachus*) were more uniformly taken at the southern trials, the largest nettings being 750 (Station 10), 484 (Station 11), 204 (Station 20), 217 (Station 21), 270 (Station 27), and 300 (Station 39), all southward of Canterbury Bight. Thence catches were meagre until hauls were made south of Hawke's Bay, when 200 examples were taken at each of two hauls (Stations 77 and 81). They were, however, the only important takes off the North Island. The total number secured during the cruise was 3,535.

Though not counted as an edible species, it will be of interest to mention that the elephant-fish (*Callorhynchus callorynchus*) formed no inconsiderable portion of a few of the hauls. At Station 45, off Lyttelton, the trawl was estimated to contain $\frac{1}{4}$ ton weight. At another haul (Station 51), in the same vicinity, 200 examples were secured, and 150 and 306 were successively taken off Otago Heads (Stations 14 and 15). These were, however, the only occasions on which the numbers taken were considered detrimental.

The appendix giving "A List of the Various Species of Fish taken in the Trawl-net, and the Stations where they were obtained," calls for some notice, and I much regret that this was not submitted to me before publication. Both common and scientific names are furnished, but it would have been well had the latter been omitted, for the gravity attending their use has not been understood, and several serious errors exist. Passing by many misspellings, which are, however, evident, and will serve only to cast doubt on the correctness of the application of the names as a whole, one or two cases of serious import may be cited.

Seriola lalandii is recorded from no less than thirty-two stations, but, as a matter of fact, this species was not once taken in the trawl. The records, on the whole, refer to *Promethichthys prometheus*, but several of them apply to *Thyrsites atun* also. These mistakes are capable of explanation, and it will be well for me to correct them here, lest they pass into purely scientific literature. Seeing that my name appears in the report, it might be too readily assumed that the identifications had the authority incidental to my association. *Seriola lalandii* is the name attached to the kingfish in the report, but the common name is applied to two distinct fishes by New Zealand fishermen. Generally speaking, the kingfish of the South Island is *Promethichthys prometheus*, that of the North Island *Seriola lalandii*. The error above alluded to results from the dual use of a popular name, and should serve as an object-lesson to those who, regarding scientific names as pedantic, do not understand the necessity of natural objects being exactly defined and correctly named.

The southern kingfish is a near relative of the barracouta (*Thyrsites atun*), and is of similar appearance. These two fishes were commonly confounded on board. Small examples of the former were almost invariably recorded as barracouta, until I drew attention to an immediate means of identification in the very different contour of the lateral lines in the respective species.

The gurnards are included under the name *Trigla kumu*, but the majority of the records apply to species of *Lepidotrigla:* these are smaller forms, not to be compared, commercially, with the larger *Chelidonichthys* (*Trigla*) *kumu*. The record is thus misleading.

I might mention other discrepancies, but, as my object is to indicate the grave errors which are bound to result in the absence of scientific knowledge, rather than to be hypercritical, I will refer to one other matter only. This, however, is of extreme interest to the ichthyologist and the student of the geographical distribution of species. I point to the records under the name "Shark": in one table this appears under Stations 47, 85, and 91, and in another table under Stations 46, 75, 80, and 91. The occurrences last noticed are recorded under the name *Heterodontus philippi*. Had these records been made at stations subsequent to my severance with the expedition, they would, in the absence of specimens, have been liable to acceptance. Fortunately, all occur within the period of my association; I am therefore able to say that the Port Jackson shark (*Heterodontus*) was not taken; moreover, no species was secured at any of the stations mentioned which could by any chance whatever be mistaken for *Heterodontus*. It is not improbable that the genus may occur in our northern waters; it has, in fact, been recorded from New Zealand—a record, however, open to doubt. This record of *H. philippi* is based on two specimens in the British Museum, presented by Professor Owen, and stated to be from New Zealand. It was accepted by Hutton,

who, however, wrote,* "I have seen no specimens." The species was subsequently eliminated, as mentioned by Gill, and has not been reinstated in the New Zealand lists. In a recent private letter Mr. Tate Regan remarks, "We have reputed examples in our (British Museum) collection." These are possibly the ones which formed the basis of the original record. From the foregoing it will be gathered that had the specimens taken by the "Nora Niven" been *Heterodontus philippi*, as reported, the circumstance would have been of very great interest indeed.

It would appear that, in some cases at least, scientific names have been fitted haphazard to the species, and I may be allowed to doubt if any specimens have been subjected to that careful and thorough examination which should precede the application of a scientific name. Such action is, of course, the result of ignorance of the necessity of scientific accuracy, and is not here attributed either to mere carelessness or design.

In closing this cursory, though, as I have indicated, necessary review of the official report, I may further mention that there is considerable discrepancy between the records and those taken by myself. Much of the official *data* was collected in a more or less hasty manner, unavoidable amid the pressure of other duties, and often from the bridge itself. Those intrusted with the compilation will, I believe, freely concede the accuracy of my observations, made by a trained zoologist, with the fishes actually in hand.

Extension of Charter.

A second cruise was commenced on the 9th September, and extended to the 3rd December, 1907.

Mr. Ayson's report† thereon was kindly forwarded to me on the 30th September, 1908, by the Hon. the Minister of Marine, and, though this report is outside the scope of the present publication, it may be briefly referred to.

I shall, however, confine my remarks to the "List of the Various Species of Fish taken in the Trawl-net," as this is the only portion affecting the scientific record. No specimens appear to have been preserved.

The "kingfish (*Seriola lalandii*)" is recorded from sixty-five stations, and though it is possible, seeing that the cruise was a northern one, that this is correct, it must be borne in mind, as before stated, that the species recorded as *S. lalandii* for the period of the first charter was *Promethichthys prometheus*.

The "gurnard (*Trigla kumu*)" is recorded from 104 stations, but there is not the slightest doubt that, as on the previous occasion, the majority of the records apply to some species of *Lepidotrigla*.

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* Hutton. Cat. Fish. N.Z., 1872, p. 80.

† Ayson. Report, Experimental Trawling, 1908.

The " shark (*Heterodontus philippi*) " again appears, and is recorded from seventy-eight stations. A reference to my previous note on this subject will show that the record is without doubt an erroneous one.

Mr. Ayson writes, " Mr. Waite's official duties prevented him from accompanying this cruise ; and it is a matter for regret that no marine biologist accompanied the expedition, as it afforded an exceptional opportunity for collecting specimens and studying marine life along a great range of the coast-line of New Zealand."

PARTICULARS OF STATIONS.

Information supplied under " Locality " is approximate only, and refers to the position of the vessel when the trawl was " shot." Accurate bearings will be given in the official report, and this, when published, should be consulted by those interested.

Station.	Date.	Locality.	Depth in Fathoms.	Nature of Bottom.
	1907.			
1	June 11	25m. east of Port Adventure, Stewart Island	54–55	Soft sand.
2	,, 12	10m. north-east of Port Adventure	37–41	Soft sand.
3	,, 12	23½m. north-east of Wreck Reef ..	40–41	Soft sand.
4	,, 12	21½m. north-east of Wreck Reef ..	50–54	Soft sand.
5	,, 13	50m. east of Wreck Reef ..	65, 183, 67	Soft sand.
6	,, 18	Off mainland, 5m. south (Waipapa Point)	26–24	Fine sand.
7	,, 19	5m. south of Chasland's.. ..	43–43	Fine sand.
8	,, 19	16m. south of White Head ..	60–58	Fine to coarse sand.
9	,, 20	5m. off Nugget Point	50–15	Sand and mud.
10	,, 20	3m. off Coal Point, Molyneux Bay..	15–10	Sandy mud.
11	,, 20	4m. off Coal Point, Molyneux Bay..	10–10	Sand and mud.
12	,, 21	Molyneux Bay, 6m. north-west of Nuggets	20–46	Sand.
13	,, 22	Off Cook's Saddle, Molyneux Bay..	27–25	Pebbles.
14	,, 22	East of Green Island, 6m. ..	25–30	Pebbles and gravel.
15	,, 24	8m. east-south-east of Otago Heads	44–38	Coarse sand.
16	,, 24	9m. south-east of Otago Heads ..	38–18	Coarse sand.
17	,, 25	8m. north-east of Cape Saunders ..	55–102	Sand.
18	,, 25	8m. east-north-east of Otago Heads	53–?6	Coarse sand.
19	,, 25	14m. north of Otago Heads ..	60–70	Coarse sand.
20	July 1	6m. east of Jones's Head ..	20–22	Fine black sand.
21	,, 1	8m. east of Shag Point	23–27	Fine sand.
22	,, 1	15½m. east of Shag Point ..	30–40	Fine sand.
23	,, 1	4m. south-east of Moeraki ..	24–13	Shell and sand.
24	,, 2	5m. east-north-east of Moeraki ..	20	Fine sand.
25	,, 2	9m. east-by-north of Look-out, Bluff	18–19	Sand and shell.
26	,, 2	19½m. south of Oamaru.. ..	40–43	Fine sand.
27	,, 2	12m. east of Oamaru	23–26	Fine sand and shell.
28	,, 3	6m. east of Oamaru	19–22	Sand.
29	,, 3	10m. east and north of Oamaru ..	25–30	Shell gravel.

Station.	Date.	Locality.	Depth in Fathoms.	Nature of Bottom.
30	July 3	18m. east-north-east of Oamaru ..	35–35	Ooze.
31	,, 3	8m. east of Waitaki River ..	24–21½	Shell sand.
32	,, 4	3½m. east-by-north of Waiho River	13–9	Stones.
33	,, 4	9m. south and east of Jack's Point	17–16	Fine sand and mud.
34	,, 4	7m. south-east of Jack's Point ..	16–21	Fine shell sand.
35	,, 4	12m. south-east and east of Jack's Point	21–29	Mud.
36	,, 5	26m. east of Jack's Point ..	35–42	Mud.
37	,, 5	37m. east of Timaru	38–44	Black mud.
38	,, 5	48m. east of Timaru	58–75	Black mud.
39	,, 6	26m. east of Timaru	28–31	Sand and shell.
40	,, 6	10m. east-north-east of Timaru ..	16–9½	Black mud.
41	,, 8	12m. north-east of Timaru ..	13–16	Black sand.
42	,, 9	31m. north-east of Timaru ..	21–24	Gravel.
43	,, 9	32m. south-west of Akaroa ..	29–30	Sand and shell.
44	,, 9	23m. south-west of Akaroa ..	30–24	Sand and shell.
45	,, 10	2¼m. north and east of Long Look-out	10–14	Sand and shell.
46	,, 11	4⅛m. north-east of Sail Rocks ..	24–35	Mud.
47	,, 11	16m. north-east and east of Sail Rocks	39–44	Sand and shell.
48	,, 11	21m. north-east of Sail Rocks ..	44–46	Sand and shell.
49	,, 12	28m. north-east of Godley Head ..	50–40	Fine sand.
50	,, 12	29m. north-east of Godley Head ..	40–28	Sand and mud.
51	,, 12	23m. north-east of Godley Head ..	28–18	Soft mud.
52	,, 15	9m. north and east of Godley Head	14–17	Soft mud.
53	,, 16	22m. north-north-east of Godley Head	16–21	Fine black sand.
54	,, 16	27m. north-east of Godley Head ..	21–27	Fine sand and mud.
55	,, 16	24m. east-by-south of Motunau Isld.	38–40	Soft mud.
56	,, 16	20m. east of Motunau Island ..	55–58	Mud and clay.
57	,, 17	4m. east-south-east of Wairau R.	26–43	Gravel and shell.
58	,, 18	11m. north-north-east of Cape Campbell	38–35	Soft sand and shell.
59	,, 18	9m. north-north-east of Cape Campbell	35–25	Gravel and shell.
60	,, 18	5m. east of White Bluff ..	25–20	Fine sand and shell.
61	,, 19	3m. north of White Bluff ..	10–15	Sand and mud.
62	,, 19	5m. north-north-east of Wairau River	15–30	Black sand.
63	,, 19	13m. south-by-west of Wellington Harbour	58–75	Gravel and shell.
64	,, 29	2m. north-west of Waitangi ..	16–24	Sand and shell.
65	,, 29	3m. south-east of Port Hutt ..	24–33	Yellow sand.
66	,, 29	5m. west of Clatchie Point ..	33–42	Fine yellow sand.
67	,, 29	5m. north-west of Durham Point..	42–50	Yellow sand.
68	,, 29	3½m. north-west of Somes Point ..	45	Coarse sand and shell.
69	Aug. 1	Hanson Bay, Chatham Islands ..	16–25	Sand and shell.
70	,, 1	Hanson Bay, 8m. north-east of Cape Fournier	33–45	Fine sand.
71	,, 12	2½m. south-west of Pencarrow Head	28–38	Rock.
72	,, 13	Palliser Bay	14–13	Fine sand.
73	,, 13	Palliser Bay	11–15	Fine sand.
74	,, 13	Palliser Bay	20–29	Fine sand.

Station.	Date.	Locality.	Depth in Fathoms.	Nature of Bottom.
75	Aug. 13	Palliser Bay	29–38	Mud.
76	,, 14	3m. east and south of Castle Point	28–19	Fine sand.
77	,, 14	4m. north-east and east of Aohanga River	23–20	Sand and mud.
78	,, 15	4½m. north-east of Cape Turnagain	24–18	Fine sand.
79	,, 15	Porangahau Bay	9	Fouled.
80	,, 15	Porangahau Bay	16–17	Fine sand.
81	,, 16	2½m. north-east of Bare Island ..	16–21	Fine sand.
82	,, 16	6m. south of Cape Kidnappers ..	21	Fine sand.
83	,, 19	12m. north-east of Cape Kidnappers	68–78	Soft mud.
84	,, 19	25m. north-east of Cape Kidnappers	82–76	Soft mud.
85	,, 20	5½m. north-east of Table Cape ..	42–42	Soft sand and mud.
86	,, 20	11m. south-east of Nick's Head ..	22–24	Sand and shell.
87	,, 20	8m. south-east of Nick's Head ..	24–23	Sand and mud.
88	,, 22	9m. west of Cape Runaway ..	105–105	Sand and mud.
89	,, 22	12m. west-south-west of Cape Runaway	94–66	Sand, shell, mud.
90	,, 22	14m. west-south-west of Cape Runaway	66–58	Mud.
91	,, 22	4m. east and south of Wakana Point	58–55	Hard mud.
92	,, 23	5m. north-west of Kaha Point ..	57–55	Hard mud.
93	,, 23	9m. north-west of Kaha Point ..	55–43	Sand and mud.
94	,, 24	20m. east-south-east of White Isld.	38–34	Sand and mud.
95	,, 24	20m. east-north-east of Whale Isld.	34–25	Sand and mud.
96	,, 24	17m. east-north-east of Whale Isld.	25–16	Sand and mud.

EXPLANATION OF PLATES.

PLATE I.

The steam trawler "Nora Niven."

PLATE II.

Model of Trawl-net and Otter-boards.

The model from which the photograph was taken was made by Captain C. A. Nielsen, the trawling-master. The ground rope, which sweeps the floor of the ocean, is seen to be greatly bowed, but the head line is stretched by the otter-boards, so that when the fishes are disturbed by the lower rope they are well covered by the net as it moves forward. Within the small or cod end are two pockets which open backwards, so that if attempting to return to the mouth of the net the fishes are entrapped. The cod-end is tied with a special knot in order that it may be readily opened when suspended over the deck of the trawler.

PLATE III

The Otter-board.

Fig. 1. The otter-boards, of which portion of the after one only is seen, have been hauled up from the bottom, and are being secured to the "gallows." The net is being gathered inboard, and one man is taking a dogfish out of the meshes.

Fig. 2. The drawing represents an otter-board of the model before referred to; the chains are adjustable so that the boards may be set to the correct angle. In the drawing, the towing-warp (on the left) is shown parallel to the board; but when in use all four chains are tight, and the board, as it stands nearly upright, is deflected, thus offering the necessary resistance to the water to stretch the mouth of the net. The right side, or "wing," of the net is attached to the shackles shown above and below, the left wing being similarly fixed to the other otter-board.

PLATE IV.

Fig. 1. The winches. Each otter-board has its own warp and winding-drum. The winches can be driven forwards, backwards, or stopped independently, so that when the otter-boards near the surface of the water each can be separately got inboard. The net can be shot at either side of the vessel as convenient.

Fig. 2. The net at the surface, buoyed by the expansion of the gases within the fishes themselves. The circular mass in the background is the cod-end, while the two lines of fishes in the foreground represent the examples caught in the pockets.

PLATE V.

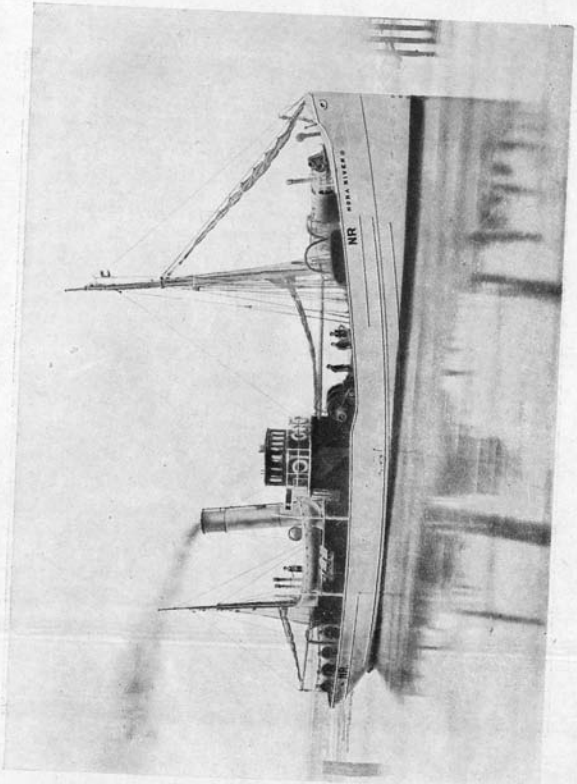
Fig. 1. Opening the net. The net hoisted clear of the deck. The picture was taken just as the cod-end was opened and the enormous catch was falling on to the deck.

Fig. 2. Swimming crabs and crayfish taken at the Chatham Islands. Every haul made at the islands produced enormous bags of these crustaceans, and, as a result, sacksful of crayfish were handed to the Maories and Morioris, who regard them as special delicacies.

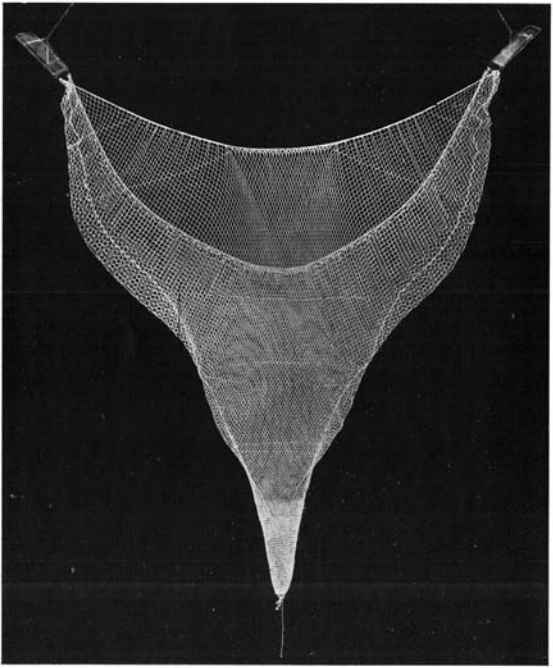
PLATE VI.

Fig. 1. So great is the buoyancy of a large haul of schnapper when drawn from deep water that the mass is capable of supporting for some time the weight of a man. An illustration of this fact is afforded by the picture as detailed in the text.

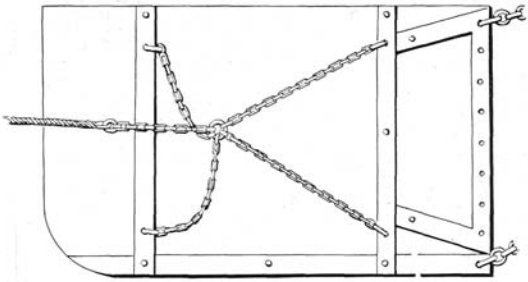
Fig. 2. A few individuals of a shoal of porpoises (*Lagenorhynchus obscurus* Gray) which accompanied the trawler. They were photographed from above, at the prow of the vessel, the white mass being foam thrown up by the bow.



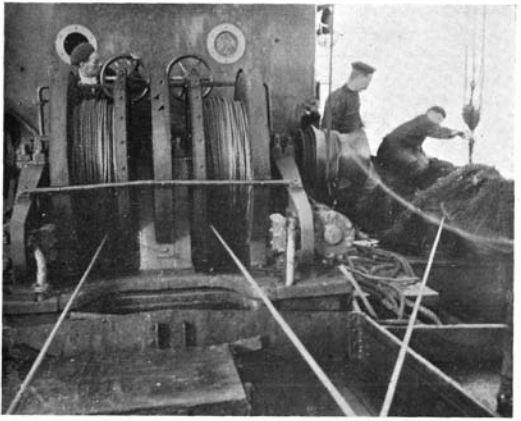
[*From a photograph.*



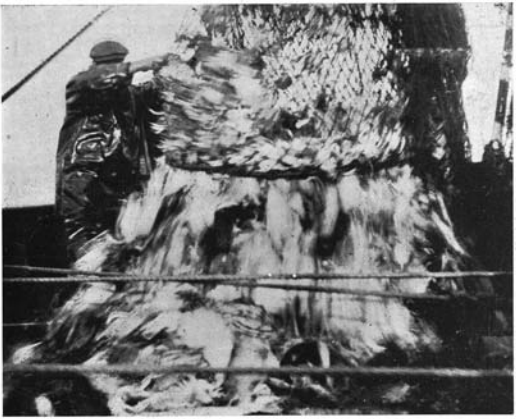
[*W. J. Sparkes, photo.*



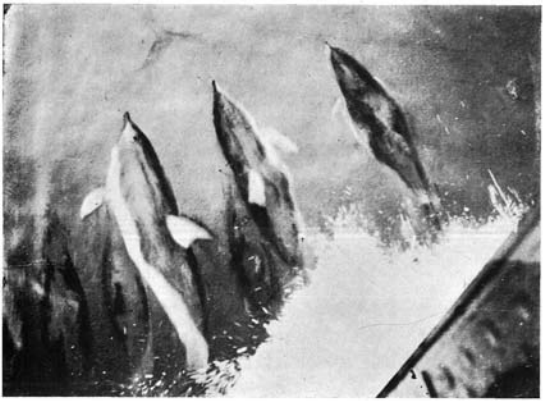
[*Edgar R. Waite, photo.*



[*Edgar R. Waite, photo.*



[*Edgar R. Waite, photo.*



[*Edgar R. Waite, photo.*

ALGÆ.*

By Robt. M. Laing, M.A., B.Sc.

These are the first seaweeds that have been dredged at greater depths than 10 fathoms off the New Zealand coast, and they are on that account of considerable interest. It is well known that the depth to which marine algæ descend depends upon the amount of light received, and that those which can grow in the deepest shade near the surface are those which penetrate to the greatest depths. It is a mistake to suppose that new and rarer forms will be found as we collect at greater depths. This may be true to a limited extent in depths between low-tide mark and 5 or 10 fathoms, but, as the following list shows, it is not true of greater depths. All the species in it are common or comparatively common plants on the coast a little below low-tide mark.

Seaweeds are rarely found deeper than 50 fathoms. Kjellman, however, obtained *Ptilota pectinata* off Spitzbergen in 150 fathoms; and there are several other cases recorded of seaweeds being obtained at greater depths than 100 fathoms.

It will be observed that the greatest depth recorded in the accompanying list is from 68 to 78 fathoms. The fact that the trawling was done in midwinter doubtless accounts to some extent for the small number of species.

CAULERPACEÆ.

Caulerpa, Lamouroux, 1809.

Caulerpa Brownii Endlicher.

Caulerpa Brownii Endlicher, Gen. Plant. Suppl., 1837–45; Van Bosse, Monographie des Caulerpes, 1893, p. 306.

Caulerpa furcifolia Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 260.

Station 83, Chatham Islands.

(Australia, Tasmania, New Zealand.)

* Pending the revisal of the rules for the nomenclature of the algæ, the species in this list are assigned to the author that first placed them in their present genus.

DICTYOTACEÆ.

Zonaria, J. Agardh, 1841.

Zonaria Turneriana J. Agardh.

Zonaria interrupta J. Agardh, Sp. Alg., i, 1848, p. 111; Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 218.

Zonaria Turneriana J. Agardh, Till. Alg. Syst., i, 1872, p. 48.

Chatham Islands.

(Australasia, South Africa, Madagascar.)

Glossophora, J. Agardh, 1880.

Glossophora Harveyi J. Agardh.

Dictyota Kunthii J. Agardh, Sp. Alg., i, 1848, p. 94; Hook f. and Harv., Fl. N.Z., ii, 1855, p. 219.

Glossophora Harveyi J. Agardh, Till. Alg. Syst., i, 1872, p. 48.

Chatham Islands.

(*New Zealand*, Chatham Islands.)

DESMARESTIACEÆ.

Desmarestia, Lamouroux, 1813.

Desmarestia ligulata Lamouroux.

Fucus ligulatus Turn., Hist., ii, 1809, p. 74.

Desmarestia ligulata Lamour., Ess. s. Thalassiophytes, 1813, p. 25; Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 217.

Station 9.

(Australasia, Chili, Fuegia, South Africa, North Atlantic, North Pacific.

LAMINARIACEÆ.

Macrocystis, C. Agardh, 1823.

Macrocystis pyrifera C. Agardh.

Fucus pyriferus Turn., Hist., ii, 1809, p. 104.

Macrocystis pyrifera C. Agardh, Revision des Alg. Macrocystis, 1835.

Station 2.

Macrocystis is not often found growing in the elittoral zone, but generally forms a belt close to the coast.

(Throughout the Southern Ocean, and along the west coast of North America, as far north as Alaska.)

ECKLONIA, Hornemann, 1828.

Ecklonia Richardiana J. Agardh.

Ecklonia Richardiana J. Agardh, Sp. Alg., i, 1848, p. 147.

Ecklonia radiata, var. γ *richardiana*, Hook. f. and Harv., Fl. Nov. Zel., ii, 1855, p. 217.

Station 6.

(The common form on the coast, and possibly confined to New Zealand.)

D'URVILLÆA, Bory, 1826.

D'Urvillæa utilis Bory.

D'Urvillæa utilis Bory, Voy. au Pôle Sud, Botan. i, 1845, p. 35.

Station 1.

It may be doubted whether the specimen was growing at the depth at which the trawl was open, 54–55 fathoms. Only a fragment was brought up by the trawl, and, as it has no air-cells, it is denser than water. D'Urvillæa, though sometimes detached from rocks and found floating, is a plant of the intertidal region. Taking these facts into consideration, and the fact that the specimen is considerably decomposed, it seems more reasonable to imagine that this is a piece which has drifted off shore, and perhaps been dropped from a larger floating mass above the spot where it was picked up by the trawl. The absence of air-cells probably shows that it is a fragment broken off from the region of the stem.

(If the rules of the Vienna Congress are adopted for cryptogams, the specific name will have to be changed to *antarctica*, as it was originally described by Chamisso as *Fucus antarcticus*.)

(New Zealand, as far south as Campbell Island, Chili, Fuegia, Falklands, Kerguelen Land.)

MARGINARIA, A. Richard, 1832.

Marginaria Boryana A. Richard.

Marginaria Boryana A. Richard, Voy. de l'Astrolabe, Botan. i, 1832, p. 9.

Stations 2, 6.

The specimen from Station 2 is without bladders, though otherwise well developed. This is a very interesting modification, probably due to the increased pressure at the depth (32–41 fathoms) at which the plant was growing. I do not remember to have seen a similar modification elsewhere recorded.

(New Zealand.)

CERAMIACEÆ.

Ballia, Harvey, 1843.

Ballia callitricha Montagne.

Ballia callitricha, Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 257.
Spacelaria callitricha C. Agardh, Sp. Alg., ii, 1820–27, p. 23.
Ballia hombroniana Mont., in Voy. au Pôle Sud, Botan., ii, 1845, p. 94.
Ballia brunonia Harv., Fl. Antarct., i, 1845, pp. 78 and 182.

Stations 2, 83, Chatham Islands. Some small sterile specimens from Station 2 are epiphytic on the base of *Marginaria*.
(All south-temperate and subantarctic seas.)

Euptilota, Kützing, 1847.

Euptilota formosissima Kützing.

Euptilota formosissima Kützing, Bot. Zeitg., 1847, p. 36.
Ptilota formosissima Mont., Voy. au Pôle Sud, Botan. i, p. 97 ; Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 257.

Station 6.

(Chatham Islands, New Zealand.)

Griffithsia, C. Agardh, 1817.

Griffithsia Sonderiana J. Agardh.

Griffithsia setacea Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 258.
Griffithsia Sonderiana J. Agardh, Epicr. Florid., 1876, p. 62.

Chatham Islands.

(New Zealand.)

RHODYMENIACEÆ.

Plocamium, Lyngbye.

Plocamium dispermum Harvey.

Plocamium dispermum Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 246.

Station 9.

A fragment of *Plocamium*, probably the same species, was dredged at Station 83.
(New Zealand.)

Plocamium brachiocarpum Kützing.

Plocamium brachiocarpum Kützing, Sp. Alg., 1849, p. 885.
Plocamium coccineum (partim) Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 246.

Chatham Islands.

(New Zealand.)

HYMENOCLADIA, J. Agardh.

Hymenocladia lanceolata J. Agardh, 1852.

Hymenocladia lanceolata J. Agardh, Act. Holm., 1870 (*v.* also Epicr. Florid., 1876, p. 314).

Station 6.

The specimen is well developed, and is remarkable in that it contains both cystocarps and tetraspores.

(New Zealand.)

EPYMENIA, Kützing, 1849.

Epymenia Wilsonis Sonder.

Epymenia Wilsonis Sond., in Linnæa, 1853, p. 516.

Epymenia obtusa Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 249 (*v.* also J. Ag., Analecta Algol. i, 1892, p. 92).

Station 9.

(New Zealand, Chatham Islands, Australia.)

SPHÆROCOCCOIDEÆ.

CURDIÆA, Harvey (Ann. Nat. Hist., Vol. 15).

Curdiæa coriacea J. Agardh.

Curdiæa coriacea J. Agardh, Epicr. Florid., 1876, p. 401.

Rhodymenia (?) *coriacea* Hooker and Harvey, London Journal, iv, p. 545.

Gracilaria coriacea Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 243.

Station 6.

A fragment of *Curdiæa*, from the Chathams, probably also belongs to this species.

(New Zealand.)

GIGARTINACEÆ.

CALLOPHYLLIS, Kützing, 1843.

Callophyllis calliblepharoides J. Agardh.

Callophyllis calliblepharoides J. Ag., Epicr. Florid., 1876, p. 231.

Station 6.

(New Zealand, Chatham Islands.)

GELIDEÆ.

PTEROCLADIA, J. Agardh, 1851.

Pterocladia lucida J. Agardh.

Pterocladia lucida, J. Ag., Spec. Alg., ii, Part 2, 1851, p. 483.

Fucus lucidus Brown, in Turn. Hist., iv, 1819, p. 98.

Stations 79 and 83.

(New Zealand, West and South-west Australia.)

DELESSERIÆ.

NITOPHYLLUM, Greville.

Nitophyllum *sp.*

Stations 79 and 83.

Fragments, scarcely to be determined.

Nitophyllum harveyanum (?) J. Agardh.

Nitophyllum harveyanum J. Agardh, Epicr. Florid., 1876, p. 462.

Nitophyllum palmatum, var. *pinnatifidum*, Hook. f. and Harv., Fl. N.Z., ii, 1855, p. 240.

The New Zealand species of *Nitophyllum* are little known and badly defined, and I refer with hesitation some fragments from the Chatham Islands to this species.

(New Zealand.)

RHODOMELACEÆ.

RHODOMELA, C. Agardh, 1820–27.

Rhodomela Traversiana J. Agardh.

Rhodomela Traversiana J. Agardh, De Alg. Nov. Zel., Mar., 1877, p. 28 (*v.* also Laing, List of New Zealand Seaweeds, No. 320, Trans. N.Z. Inst., xxxiv, 1901, p. 352).

Station 6.

(New Zealand.)

LENORMANDIA, Sonder, 1845.

Lenormandia angustifolia J. Agardh.

Lenormandia angustifolia J. Agardh, De Alg. Nov. Zel., Mar., 1877, p. 30.

Chatham Islands.

(New Zealand.)

ANNELIDA AND SIPUNCULOIDEA.

By W. B. Benham, D.Sc., F.R.S., University of Otago.

ANNELIDA POLYCHÆTA.

Figs. 1–5.

The collection of annelids is a small one, containing only twenty-two species, of which only three were not represented in my own collection. These are *Sthenelais semitecta*, a comparatively rare species; *Onuphis tenuisetis*, which has not been recorded since the type was obtained by the "Challenger" off the East Cape; and *Goniada eximia*, which is of special interest, as it is a South American and Magellan form, not hitherto obtained from the neighbourhood of New Zealand.

The identification of the series of worms was rendered comparatively easy owing to the fact that I have been for the last eight years or so accumulating in the Otago University Museum annelids from all parts of the coast visited by me, or by my correspondents in other parts of New Zealand; so that it contains nearly all the species which have been recorded from our coastal waters. I had proposed to describe them, but, a few years ago, on hearing from Professor Ehlers, of Göttingen, that he was engaged in the examination of the Polychæta of the "Valdivia" and other expeditions, I forwarded a set of species to him for description, and he has published two illustrated memoirs on our New Zealand annelids. I have also forwarded to the British Museum representatives of a considerable number of our species. In the present report I have added notes on geographical distribution in the case of those species which have been recorded outside the New Zealand area.

It is to be regretted that no polychætes were obtained at Station 88, where a depth of 105 fathoms was reached, nor from other spots off the east coast of the North Island, since the few that appear to have been got off Cape Kidnappers, at a depth of 68–78 fathoms, are very interesting forms.

Family APHRODITIDÆ.

Aphrodita, Linnæus, 1758.

Aphrodita talpa Quatrefages.

Aphrodita talpa Quatrefages, Hist. Nat. d. Anneles, i, 1865, p. 196, pl. vi, figs. 2–4.

Stations 7, 30.

Localities.—South of Chasland's, 43 fathoms, fine sand; off Oamaru, 35 fathoms, ooze.

Aphrodita terræ-reginæ Haswell.

Aphrodita terræ-reginæ Haswell, Proc. Linn. Soc. N.S.W., vii, 1883, p. 271.

Station 30.

Locality.—Off Oamaru, 35 fathoms, ooze. Originally described from New South Wales.

Physalidonotus, Ehlers, 1904.

Physalidonotus squamosus Quatrefages.

Aphrodita squamosa Quatrefages, Hist. Nat. d. Anneles, i, 1865, p. 201.

Lepidonotus giganteus Kirk, Trans. N.Z. Inst., xi, 1879, p. 400; Benham and Thomson, P.Z.S., 1900, p. 974, pls. lx, lxi, lxii.

Physalidonotus squamosus Ehlers, Neuseel. Annel., in Abhandl. K. Gesellsch. Wiss., Göttingen (N.S.), iii, 1904, p. 10.

Stations 26, 30, 44.

Localities.—South of Oamaru, 40–43 fathoms, fine sand; E.N.E. of Oamaru, 35 fathoms, ooze; S.W. Akaroa, 24–30 fathoms, sand and shell. This gigantic polynoid is fairly common round our coasts. It is apparently nearly related to two Japanese species described by J. P. Moore in 1903.

Lepidonotus, Leach, s. str. Kinberg, 1857.

Lepidonotus polychroma Schmarda.

Lepidonotus polychroma Schmarda, Neue Wirbellose Thiere, i (ii), 1861, p. 153, pl. xxxvi, fig. 307; Ehlers, Neuseel. Annel., 1904, p. 7, pl. i, figs. 1–6.

Locality.—Chatham Island. It is common under stones all round our coast.

Sthenelais, Kinberg, 1857.

Sthenelais semitecta Ehlers.

Sthenelais semitecta Ehlers, Neuseel. Annel., 1904, p. 10, pl. i figs. 10–12, pl. ii figs. 1–4.

Stations 83 (? or 30).

Locality.—Probably N.E. of Cape Kidnappers,* 21 fathoms, fine sand. It seems to be a rare worm. It has also been obtained at Lyttelton by Mr. H. Suter.

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* In a bottle containing this and several other worms were two labels—one "83," the other "30." On several occasions I have obtained material dredged off Oamaru, and have not seen the species: hence I conclude that these worms were obtained at Station 83.

Family AMPHINOMIDÆ.

CHLOEIA, Savigny, 1820.

Chloeia inermis Quatrefages.

Chloeia inermis Quatrefages, Hist. Nat. d. Anneles, i, 1865, p. 389.

Locality.—Stewart Island, "cast ashore after a storm"; two individuals. I have also specimens from Wellington and Otago, also thrown ashore.

Family PHYLLODOCIDÆ.

CAROBIA, Quatrefages, 1865 (Marenzeller rev. 1874).

Carobia ochracea Ehlers.

Carobia ochracea Ehlers, Neuseel. Annel., 1904, p. 15, pl. ii, figs. 5–7.

Station 83 or 30.

Locality.—Cape Kidnappers* (or off Oamaru).

Family LYCORIDÆ.

NEREIS, Cuvier, 1817.

Nereis australis Schmarda.

Heteronereis australis Schmarda, Neue Wirbell. Thiere, i (ii), 1861, p. 101, pl. xxxi, fig. 242.
Nereis australis Ehlers, Neuseel. Annel., 1904, p. 26, pl. iii, figs. 16–20, and pl. iv, figs. 1, 2; and ii, 1907, p. 11.

Locality.—Chatham Islands. It is common, and has not been recorded elsewhere than on the coast of New Zealand.

Nereis vallata Grube.

Nereis vallata Grube, Annulata Oerstediana, 1857, p. 159.
Nereis maculata Schmarda, *loc. cit.*, 1861, 102.
Nereis latipalpa Schmarda, *loc. cit.*, 104.
Nereis pacifica Schmarda, *loc. cit.*, 107.
Nereis brevicirris Grube, Annel. Reise "Novara," 1867, p. 19, pl. ii, fig. 2.
Nereis mictodonta Marenzeller, Sudjapan. Annel., 1879, p. 10, pl. ii, fig. 2.
Nereis vallata Ehlers, Die Polychæten d. magell. u. chilen Strandes, 1901, p. 110; Neuseel. Annel., 1904, p. 26., and ii, 1907, p. 11.

Locality.—Chatham Islands. This is quite the commonest nereid found in mud under stones along our coast. It occurs also on the coasts of Chili and of South Japan.

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* See footnote on previous page.

Nereis amblyodonta Schmarda.

Nereilepas amblyodonta Schmarda, *loc. cit.*, 1861, p. 106, pl. xxxi, fig. 245.

Perinereis novæ-hollandiæ Kinberg, Annulata Nova, Ofvers K. Vet. Akad. Förhandl., 1865, p. 175, pl. xx, fig. 9.

Nereis amblyodonta Ehlers, Neuseel. Annel., 1904, p. 29, and ii, 1907, p. 11.

Locality.—Chatham Islands. It is a large handsome form, of a dark-green colour; not uncommon on our coast. It was originally described from Port Jackson.

Family EUNICIDÆ.

EUNICE, Cuvier, 1807.

Eunice australis Quatrefages.

Eunice australis Quatrefages, Hist. Nat. d. Anneles, i, 1865, p. 321.

Eunice paucibranchis Grube, Bericht Schlessisch. Gesellsch., 1866, p. 64, and the same, 1877, p. 56.

Eunice leuconuchalis Benham, Report on Experimental Trawling, 1900, p. 21.

Eunice australis Ehlers, Neuseel. Annel., 1904, p. 30, and ii, 1907, p. 12.

Station 12.

Locality.—Molyneux Bay.

It has been obtained from other parts of the coast, and Grube reports it from Samoa.

Eunice antennata Savigny.

Leodice antennata Savigny, Système des Annelides, 1820, p. 50, pl. v, fig. 1.

Eunice gaimardi Quatrefages, Hist. Nat. des Anneles, i, 1865, p. 321.

Eunice antennata Crossland, P.Z.S., 1904, i, p. 312, pl. xxii, figs. 1–7.

Eunice antennata Ehlers, Neuseel. Annel., ii, 1907, p. 12.

Stations 26, 30.

Localities.—Off Oamaru, 35–43 fathoms, ooze and fine sand. One would scarcely have expected that this species would be found off the shores both of Africa and of New Zealand, but it has been obtained off the coast of Ceylon, and is widely distributed in the Pacific.

Eunice aphroditois Pallas.

Nereis aphroditois Pallas, Nova Acta Acad. Sci. Inst. Petersburg, ii, 1788, p. 229.

Leodice gigantea Savigny, Système des Annelides, 1820, p. 49.

Eunice macrobranchia Schmarda, *loc. cit.*, 1861, p. 130, pl. xxxii, fig. 258.

Eriphyle capensis Kinberg, Ofvers K. Vet. Akad. Forh., 1864, p. 385.

Eunice gigantea Quatrefages, Hist. Nat. des Annel., i, 1865, p. 311.

Eunice aphroditois Ehlers, Die Börstenwürmer, 1868, p. 306; McIntosh, "Challenger" Reports, xii, Annel. Polychæta, p. 282, 1885; Gravier, Nouv. Arch. du Mus. Paris, 1900, p. 224; McIntosh, Polychæta of South Africa (Marine Investigations f South Africa), iii, 1903, p. 42; Crossland, P.Z.S., 1904, i, p. 288; Ehlers, Neuseel. Annel. ii, 1907, p. 12.

Stations 22, 83, 95.

The specimens are in fragments. Although I identify it with this large species, which is already recorded from our shores, the specimen differs in coloration from that usually described, for these specimens are pale-brown (in formalin), with very dark purplish-brown spots and splashes of irregular form, size, and arrangement, not only on the dorsal surface, but, in less numbers and of smaller size, on the ventral surface; nor is there the characteristic white band on the fourth segment. But in all structural characters it agrees with Pallas's species, which has a very wide distribution.

Localities.—East of Shag Point, 30–40 fathoms, fine sand; E.N.E. of Whale Island (North Island), 25–34 fathoms, sand and mud.

Onuphis, Audouin and Milne-Edwards, 1833.

Onuphis tenuisetis McIntosh.

Nothria tenuisetis McIntosh, "Challenger" Reports, xii, 1885, p. 307, pl. xl, figs. 8, 9, pl. xxi*a*, figs. 24–26.

Station 83 ?

It is with some hesitation that I refer the worm described below to this species, from which, indeed, it differs in one character. But, as the species was obtained off the East Cape and nowhere else, it is not improbable that the difference is of little importance; so I will give a full account of the external features of the present worm.

I have come to the same conclusion as Dr. Willey, and am unable to find any justification for the retention of Johnston's genus *Northia*—or, as Malmgren and McIntosh prefer to write it, *Nothria*.

The worm inhabits a thick-walled tube composed of fine grey mud.

A complete individual measures 74 mm. in length, with 170 segments, and 5 mm. across the parapodia.

The anterior third of the worm has a thick body-wall, very pale brown in colour, but posteriorly the wall becomes thin, colourless, and transparent. The prostomium, frontal tentacles, palps, and margins of the mouth, as well as the mid-dorsal region of the first four segments of the body, are tinged with a pale rose-purple.

The five dorsal prostomial tentacles are smooth, and have a well-marked ringed base; the three middle tentacles are of nearly equal size, reaching, when pressed back, to the twentieth segment or further. The laterals are much shorter, touching only the fifth chætigerous segment. Black pigment-masses are visible within the bases of the three middle ones, which may be eyes.

The short nuchal tentacles (peristomial cirri) are only about half as long as the lateral tentacles.

The first, or peristomial, segment is short, but the succeeding five are long, each having a length equal to about one-third of its width; then the segments soon decrease in length, so that at the ninth they are only one-sixth of the width (but at the same time the width has increased); further back they become still shorter.

The first six parapodia are long, widely separated, and the anterior ones are directed somewhat forwards. They measure about half the width of the body. Further back, and rather abruptly, as the segments become shorter, the parapodia become compressed, and lie close together; they also decrease much in length. Thus the first chætigerous segment has a body only 2 mm. across, whilst the distance from tip to tip of the feet is 5 mm. At about the fifteenth segment the total breadth remains the same, but now the body itself is 4 mm. in diameter.

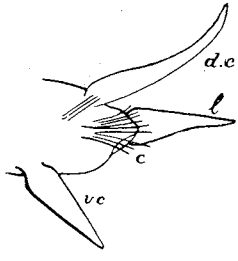

Fig. 1. The first parapodium (enlarged): *c*, the two hooks below the bundle of chætæ; *dc*, the dorsal cirrus; *l*, the lip-process of the chætophore; *vc*, the ventral cirrus.

The first parapodium carries a long dorsal cirrus, a long slender lip-process, and a long ventral cirrus, which does not reach the tip of the lip-process. There are but few chætæ in this foot; they are fine, simple, and pointed, with a few (3 or 4) stout, yellow, hooded, and hooked bristles, below the terminal hook of which there are numerous shorter denticulations of unequal size. The distal portion of the bristle, some distance from the apex, is semi-articulated at a nearly transverse line. (Fig. 5.)

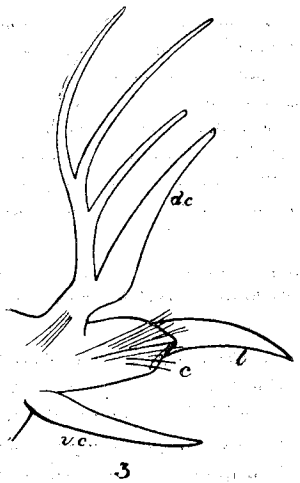

Fig. 2. The fourth parapodium, on the same scale as Fig. 1.

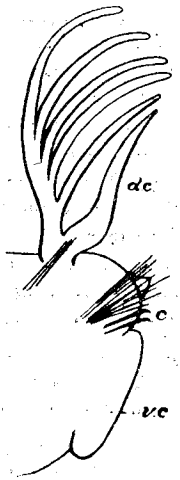

Fig. 3. A parapodium from the mid-body, on the same scale. Letters as in Fig. 1.

The fourth foot is similar in form, and has two similar chætæ. After the sixth foot the ventral cirrus becomes shorter and is reduced to a scale or pad.

But further back the foot exhibits several differences: the dorsal cirrus is smaller; the ventral is represented by a slight pad; the whole foot is less prominent. Below the bundle of chætæ are two stout hooks, stouter than those of the earlier parapodia: they have a shorter but wider hood, and the distal region is not articulated; the tip is curved and bears two prongs, the upper being much smaller than the lower, which is bifid. I did not note exactly where the change in the form of the bristles occurs, but it exists already in the fifteenth foot. (Fig. 4.)

Fig. 4. One of the stout hooks of the mid-body.

Fig. 5. A characteristic hook from the anterior parapodia.

These bristles, both of the anterior and posterior feet, agree closely with those described and figured by McIntosh for *Onuphis* (*Nothria*) *tenuisetis*.

The gills commence on the second foot and extend throughout the body. The first consists of a single slender filament springing

from the base of the dorsal cirrus, and nearly equalling it in length, though of less thickness. On the third foot the gill bifurcates, and on the fourth it consists of three filaments, and now overtops the cirrus; by the ninth foot there are four filaments, and the cirrus has gradually decreased in size. Further back, on the twelfth foot, the maximum number of five filaments is attained, and this is retained for a few segments, but then is reduced to four. In the anterior half of the body the gill then consists of four filaments, and then the number gradually decreases.

The gills on the first 20–25 segments are large, and stand upright over the back; they gradually decrease in length, and by the fortieth foot project outwards over the foot.

The Tube presents two regions—(*a*) a thick-walled, mud-coated portion, which no doubt projects into the water; and (*b*) a thin, membranous portion, which is probably imbedded in the sea-floor.

Most of the tubes were broken off below the mud region; but in a complete one, measuring 103 mm., this upper region accounts for 25 mm., and has an external diameter of 6 mm., and the wall is about 1 mm. thick. It consists of a fine grey sandy mud, lined by a thin membrane presenting horizontal streaks of brown colour. Further down the mud ceases, and the membrane gradually loses the brown streaks, becomes colourless and transparent. Examined under a microscope, the membrane is seen to be made up of fibrillæ in horizontal, vertical, and oblique directions.

Externally this tube is exactly like that of *Dasychone serratibranchis*, but in the sabellid the lining-membrane is much thinner—indeed, in the upper mud-covered region it does not exist, for on scraping away the mud nothing is left. But further from the mouth of the tube it makes its appearance as a colourless, smooth, and structureless lining.

Locality.—Probably off Cape Kidnappers.*

Remarks.—I have identified this worm with McIntosh's species on the following grounds: (1) *O. tenuisetis* was obtained off the East Cape; (2) the peculiarity of the anterior bristles, emphasized by McIntosh, is repeated in my specimens; (3) the general agreement of the parapodia. On the other hand, evident differences are presented by the form and extent of the gills, for in the type they do not commence till the tenth segment, do not become bifid till the twentieth, and never attain the complexity seen in our individuals, for they soon reassume the simple form they have in the earlier segments—even before the fortieth foot is reached.

* This is one of the specimens in the bottle which contained two station-numbers; and I attribute it to 83, because it has not been hitherto recorded from the Oamaru region, whereas the species was originally obtained south of the East Cape by the "Challenger."

The question arises, How far is the condition of the gills a specific character: do they increase in their extent of distribution along the body, and in complexity of structure, with age?

It appears that in this case, if I am right in my identification, the size of the worm is not a factor, for the individual described by McIntosh was 105 mm. in length, while the present worms do not exceed 74 mm.

It is only in recent years that zoologists have paid any attention to the matter. Thus, Crossland,* in discussing the variability of characters, usually regarded as being of specific value, says of *Marphysa mossambica*, "The gills begin on different segments in different specimens, increase in size and complexity quite irregularly, and vary in the maximum number of filaments they bear." This opinion agrees with that at which I have arrived as a result of the studying of our native polychætes. And it appears that McIntosh† himself is more inclined to lay stress on this anatomical feature than formerly, for, in speaking of a species of *Onuphis* from the Gulf of St. Lawrence, he says that it "may be *O. holobranchiata* Marenzeller; appears to approach *O. grubei* Marenzeller, a form which comes near *Nothria tenuisetis*, especially in the structure of the bristles, though there are certain differences, such as the origin of the branchiæ."

I may mention that in *O. holobranchiata* the gills commence on the first foot and remain single throughout the body. The species, too, has quite a different tube.

LUMBRICONEREIS (Blainville), Grube, 1851.

Lumbriconereis sphærocephala Schmarda.

Lumbriconereis sphærocephala Schmarda, Neue Wirbell. Thiere, i (ii), 1861, p. 116; Ehlers, Neuseel. Annel., 1904, p. 33, pl. v, figs. 3–11.

Stations 12, 14.

This is pretty common in muddy shores round the coast of New Zealand, and has been obtained from the Chatham Islands.

Localities.—Molyneux Bay, 20–46 fathoms, sand; off Otago Peninsula, 25–27 fathoms, pebbles.

Family GLYCERIDÆ.

GLYCERA, Savigny, 1820.

Glycera ovigera Schmarda.

Glycera ovigera Schmarda, Neue Wirbell. Thiere, i (ii), 1861, p. 295, pl. xxx, fig. 239; Ehlers, Neuseel. Annel., 1904, p. 37.

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* Crossland, P.Z.S., 1903, ii, p. 120.

† McIntosh, Ann. Mag. Nat. Hist. (7), xii, 1903, p. 152.

Stations 12, 14, 26, 30, 89.

Localities.—Molyneux Bay, 20–46 fathoms, sand; Green Island (Otago), 25–30 fathoms, pebbles and gravel; south of Oamaru, 40–43 fathoms, fine sand; E.N.E. of Oamaru, 35 fathoms, ooze; off Cape Runaway (from the stomach of *Zeus faber*). This worm is quite common from Stewart Island to Auckland.

Family GONIADIDÆ.

Goniada, Audouin and Edwards, 1853.

Goniada eximia Ehlers.

Goniada eximia Ehlers, Die Polychæten d. magell. u. chilen Strandes, 1901, p. 157, pl. xx, figs. 7–17.

Station 83 (or 30).

Locality.—Either off Cape Kidnappers, 68–78 fathoms, soft mud, or off Oamaru.

The specimen differs slightly from Ehler's account of those obtained off Tierra del Fuego, in that, instead of only four angulated micrognaths on each side of the base of the everted pharynx, I find about twenty. It has been suggested by Ehlers that the number may depend upon age, as some of his specimens had none at all. And I do not feel justified in making a new species on such a small difference.

Family TEREBELLIDÆ.

Lanice, Malmgren, 1865.

Lanice conchilega Pallas.

Nereis conchilega Pallas, Miscell. Zool., 1766, p. 131, pl. ix, figs. 14–22.

Terebella conchilega Savigny, Syst. des Annel., 1820, p. 85, pl. i, fig. 3; Johnston, Catalogue of Worms, Brit. Mus., 1865, p. 235; Quatrefages, Hist. Nat. d. Annel., ii, 1865, p. 255, pl. xix, fig. 2.

Lanice conchilega Malmgren, Nordiska Hafs Annulater, 1866, p. 380; St. Joseph, Ann. Sci. Nat. (Zool.), Ser. 7, xvii, 1894, p. 211 (where a complete list of references will be found); Ehlers, Neuseel. Annel. (ii), 1907, p. 27.

Station 12.

Locality.—Molyneux Bay, 20–46 fathoms, sand.

This worm, identified by Ehlers, from specimens forwarded to him by me, as the common terebellid of European shores, is not uncommon on sandy beaches in New Zealand.

Family SABELLIDÆ.

Branchiomma (Kolliker), Claparede, 1868.

Branchiomma suspiciens Ehlers.

Branchiomma suspiciens Ehlers, Neuseel. Annel., 1904, p. 62, pl. ix, figs. 1–6.

A bunch of the characteristic parchment-like horn-coloured tubes, with the animals within, was sent to me, but without indication of the station. It is, however, common round our coasts.

Dasychone, Sars, 1862.

Dasychone serratibranchis Grube.

Dasychone serratibranchis Grube, Annulata Semperiana, 1878, p. 262, pl. xiv, fig. 7; Ehlers, Neuseel. Annel. (ii), 1907, p. 28.

Station 12.

Locality.—Port Molyneux, 20–46 fathoms, sand.

The species was originally described from the Philippines. I have specimens from Auckland Harbour.

Family SERPULIDÆ.

Galeolaria, Lamarck, 1801.

Galeolaria hystrix Mörch.

Galeolaria hystrix Mörch, Revisio Critica Serpulidarum, Naturhist. Tidskr., 3 R., i Bd., 1863.

Eupomatus boltoni Baird, Journ. Linn. Soc. (Zool.), viii, 1864, p. 12, pl. i fig. 2, pl. ii fig. 10.

Vermilia rosea Quatrefages, Hist. Nat. d. Annel., ii, 1865, p. 532, pl. xx, figs. 10, 11; Haswell, Proc. Linn. Soc. N.S.W., ix, 1885, p. 667, pl. xxxii, figs. 2–5.

Galeolaria rosea Ehlers, Neuseel. Annel., 1904, p. 70.

Galeolaria hystrix Ehlers, Neuseel. Annel. ii, 1907, p. 29.

Station 44.

A single tube with the animal was received by me from south-west of Akaroa, 24–30 fathoms, sand and shell. It is very common on rocks round our coast.

Family CHÆTOPTERIDÆ.

(?) Spiochætopterus, Sars, 1859.

Stations 12, 26.

Numerous slender, transparent, horn-coloured, parchment-like tubes, which I refer provisionally to this genus; but, as the animal is imperfectly preserved, I refrain from attempting to identify it more accurately.

SIPUNCULOIDEA.

Family SIPUNCULIDÆ.

PHASCOLOSOMA, Leuckart.

Phascolosoma novæ-zealandiæ Benham.

Phascolosoma novæ-zealandiæ Benham, Trans. N.Z. Inst., xxxvii, 1905, p. 301, pls. xv and xvi.

Station 30.

Locality.—E.N.E. of Oamaru, 35 fathoms, ooze.

The type was obtained from the stomach of the smooth-hound (*Mustelus antarcticus*), which had been trawled off the coast of Otago, no doubt in the neighbourhood of this station.

PHYSCOSOMA, Selenka, 1897.

Physcosoma annulatum Hutton.

Phascolosoma annulata Hutton, Trans. N.Z. Inst., xii, 1879, p. 278.
Physcosoma annulatum Benham, Trans. N.Z. Inst., xxxvi, 1904, p. 173, pl. vii, figs. 1–10.

Three specimens. No locality given. It is widely distributed round our coasts.

ECHINODERMA.

By W. B. Benham, D.Sc., F.R.S., University of Otago.

Plates VII–XI.*

Mr. Waite was good enough to place the echinoderms in my hands for identification, which at first seemed likely to be no serious task, for this Museum has a good collection of native representatives of the group, while the useful lists and notes and descriptive papers by Mr. Farquharson served to simplify the task.

One of the first species that I happened to examine was the so-called *Salmacis globator*, in reality an *Echinus*, an account of which I have recently published. The discovery that this little *Echinus* had for nearly thirty years been masquerading under a name to which it had no shadow of right put me on my guard as to the possibilities of other errors having crept into identifications made in early days of zoological research in New Zealand. Again, I soon found that the generic names of some of our best-known starfishes have in recent years received new interpretations, necessitating the removal of the species to other genera, and that old genera have been broken up as an outcome of new knowledge.

I was thus soon involved in the tedious task of searching the "Zoological Record" for the last twenty years—that is, the period that has elapsed since the publication of the report of the "Challenger"—and during this period several important expeditions have been undertaken by American and European scientific men to all parts of the ocean, which has resulted in a great accession of new material, and has led to repeated revision of the work of earlier naturalists.

Unfortunately, the reports of these expeditions are not available in the libraries in New Zealand, hence I have had to rely on the meagre information contained in such text-books as Bronn's "Thier-reichs," the "Zoological Record," and a few memoirs to which I happen to have access; so that, under the circumstances, it is quite possible that I have fallen into new errors. For example, relying on the "Thier-reichs" and on Yves-Delages' "Zoologie Concrete" as being trustworthy guides in systematic work, I placed *Echinus albocinctus* in Mortensen's genus *Pseudechinus;* but I have since become aware

* For explanation of plates see p. 115.

that his method of work, and the grounds for the rearrangement of the genera, are considered by such authorities as Agassiz and Loriol as injudicious and unscientific. The task of the systematist in a land without modern books or scientific periodicals is a difficult one, but the work has to be done; we have to do our best, and offer our apologies if inaccuracies creep in.

I have to thank Mr. Farquharson for much help and advice contained in letters in reply to my queries, and for the loan of foreign memoirs.

Although the collection is not very extensive, it adds a few genera to our list, and some species new to science.

A total of twenty-six genera and thirty-one species is recorded.

Of thirteen species of asterids, belonging to ten genera, there are three genera which have not hitherto been recorded from our area—viz., *Odontaster*, *Mediaster*, and *Luidia*.

Of ophiurids there are six genera, each represented by one species; of which one genus (*Astrotoma*) has not previously been obtained from so southern a latitude.

The echinids are represented by seven species, belonging to five genera, of which one genus (*Porocidaris*) is new to the New Zealand fauna.

Of the five species of holothurians, representing as many genera, one species of *Molpadia* appears to be new to science.

Amongst the most interesting finds is *Odontaster grayi*, hitherto recorded only from the neighbourhood of Tierra del Fuego—another instance of the subantarctic nature of much of our marine fauna.

The occurrence of a species of *Mediaster*, closely allied to but not identical with *M. arcuatus*, from the Japanese seas, adds another link with the fauna of that region of the Pacific, which is illustrated by the gephyrean *Echiurus novæ-zealandiæ*, by the hemichordate *Dolichoglossus otagoensis*, and by certain annelids. But species of the genus *Mediaster* also occur in the eastern Pacific off the west coast of the American continent, from Vera Cruz, Cocos Island, and Acapulco. The occurrence, then, of a species in the western Pacific marks an important extension of the range of the genus.

Astrotoma waitei is another interesting connection between the species found in the Banda Sea and Sulu Archipelago on the one hand, and that found in the Strait of Magellan on the other; while the presence of *Porocidaris elegans*, hitherto recorded from the neighbourhood of Sydney and the Philippines, represents still another element in our fauna—the tropical one.

Of the holothurians, two deep-water forms occur, of which *Molpadia marenzelleri* had hitherto only been obtained by the "Challenger" from our seas.

Some confusion in the records resulted from accidents happening on board the trawler, during heavy weather, as explained by Mr. Waite in the "Introduction."

LIST OF SPECIES OBTAINED.

Class ASTEROIDEA.

Order PHANEROZONIA.

Family ASTROPECTINIDÆ.

Psilaster, Sladen, 1885.

P. acuminatus Sladen.

Luidia, Forbes, 1839.

L., sp. incert.

Family ARCHASTERIDÆ.*

Odontaster, Verrill, 1880.

O. grayi Bell.

Asterodon, Perrier, 1891.

A. miliaris Gray.

Family PENTAGONASTERIDÆ.

Pentagonaster, Gray, 1840.

P. pulchellus Gray.
P. abnormalis Gray.

Mediaster, Stimpson, 1862.

M. sladeni sp. nov.

Family ASTERINIDÆ.

Asterina, Nardo, 1834.

A. regularis Verrill.

Order CRYPTOZONIA.

Family STICHASTERIDÆ.

Stichaster, Muller and Troschel, 1840.

S. polyplax Muller and Troschel.
S. insignis Farquhar.

Family ECHINASTERIDÆ.

Echinaster, Muller and Troschel, 1840.

E. farquhari sp. nov.

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* I have followed Bell, Hamann, Delages, in placing these two genera in this family instead of in the next.

Family ASTERIDÆ.

Asterias, Linnæus, 1766.

A. calamaria Gray.

A. mollis Hutton.

Class OPHIUROIDEA.

Order STREPTOPHIURIDA.

Family OPHIOMXYIDÆ.

Ophiomyxa, Muller and Troschel, 1842.

O. australis Lutken.

Order CLADOPHIURIDA.

Family ASTRONYCIDÆ.

Astrotoma, Lyman, 1875.

A. waitei sp. nov.

Order ZYGOPHIURIDA.

Family AMPHIURIDÆ.

Amphiura, Forbes, 1842.

A. norœ sp. nov.

Ophionereis, Lutken, 1859.

O. schayeri Muller and Troschel.

Ophiactis, Lutken, 1856.

O. nomentis Farquhar.

Family OPHIODERMATIDÆ.

Pectinura, Forbes, 1842.

P. maculata Verrill.

Class ECHINOIDEA.

Sub-class REGULARIA.

Order CIDARIDA.

Family CIDARIDÆ.

Goniocidaris, Desor, 1846.

G. umbraculum Hutton.

Porocidaris, Desor, 1854.

P. elegans Agassiz.

Order DIADEMOIDA.

Family ECHINIDÆ.

Echinus, Linnæus, 1758.

E. angulosus (?) Leske.
E. albocinctus Hutton.
E. huttoni Benham.

Sub-class IRREGULARIA.

Order CLYPEASTRIDA.

Family CLYPEASTRIDÆ.

Arachnoides, Agassiz, 1841.

A. placenta Linnæus.

Order SPATANGIDA.

Family SPATANGIDÆ.

Echinocardium, Gray, 1845.

E. australe Gray.

Class HOLOTHUROIDEA.

Order ACTINOPODA.

Family CUCUMARIDÆ.

Phyllophorus, Grube, 1840.

P. longidentis Hutton.

Family MOLPADIDÆ.

Caudina, Stimpson, 1853.

C. chilensis J. Müller.

Molpadia, Cuvier, 1817.

M. marenzelleri Theel.
M. dendyi sp. nov.

Order PARACTINOPODA.

Family SYNAPTIDÆ.

Chirodota, Eschscholtz, 1829.

C. gigas Dendy.

DESCRIPTION OF THE SPECIES.

Psilaster acuminatus Sladen.

Psilaster acuminatus Sladen, "Challenger" Report, Asteroidea, xxx, 1889, p. 225.

Station 7.

Four specimens were obtained, the largest of which measures R. = 70 mm., r. = 15 mm., breadth of arm at base 16 mm. The ratio of r. to R. is rather less than 1 to 4·6. The colour of the dried specimens is pinkish-brown on the upper surface. Of these four, one was obtained off the south coast of the South Island, at a depth of 43 fathoms; the three others had no number attached, but were no doubt obtained off the east coast of the South Island.

[In addition, I have a specimen in the Otago University Museum which shows the characteristic adpressed inframarginal spines better than the above, for it is uninjured.]

Localities.—South of South Island [also (O.U.M.) west coast of North Island: and ("Challenger"), near western entrance to Cook Strait].*

Luidia, sp.

Plate X, figs. 4, 5.

Station 89.

Two arms, or portions of arms, were amongst the material dredged off Cape Runaway, on the east coast of the North Island, from a depth of 66–94 fathoms. The long, slender, tapering form of the arms recalls the figure of *L. africana* Sladen [35, p. 256],† which, however, comes from the Atlantic. I refrain from giving a name to these fragments, but will put on record the description, which may lead to the identification of the species by others who have access to more literature than is available here.

The arm is 35 mm. in length and 6 mm. across the broader end, tapering to a point.

The abactinal surface is densely covered with small paxilli consisting of rough, thorny spines; each plate bears a central rather larger one surrounded by a circle of nearly horizontally disposed spines.

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* I enclose in square brackets New Zealand localities in addition to those at which they were obtained during this expedition. "O.U.M." means that a specimen is in the Otago University Museum, and "F." that Mr. Farquhar has recorded it.

† The figures within square brackets refer to the bibliography at the end of the paper.

The margin of the arm presents only a single row of marginals (identified as inframarginal in this genus); each bears two spines, long and white, which are differently arranged on alternate plates. One series of plates bears a spine close to the upper (abactinal) margin, and a second one of nearly the same length about half-way down the lateral face; on the alternate plates, however, the upper spine arises at a spot about one-quarter of the height of the plate, and the second, which is shorter, near the lower (actinal) margin. So that, looked at lengthwise, the arm has four rows of spines; they are fine-pointed, circular in section, the upper ones being slightly larger than the other, and measure 4 mm.—*i.e.*, they are nearly as long as the width of the arm. The species appears to be characterized by this alternate arrangement of the spines.

In addition, the marginals bear numerous very short delicate spinules in two vertical rows before and behind the large spines: they are covered by a pale reddish-brown skin. I see no pedicellariæ. The adambulacrals carry two spines: one short, geniculate, springs from within the groove, and a larger one from the actinal surface, about 2 mm. in length, or half that of the marginal spines. From around its base spring a few short spines as on the marginals. There is thus a resemblance to *L. longispina* Sladen (p. 254).

Odontaster grayi Bell.

Calliderma grayi Bell, P.Z.S., 1881, p. 95.

Gnasthaster grayi Sladen, "Challenger" Report, xxx, 1889, p. 750.

Odontaster grayi Bell, P.Z.S., 1893, p. 261; Ludwig, Zeit. f. Wiss. Zool., lxxxii, 1905, p. 44.

A single individual was obtained. Unfortunately, no station-number was attached when it reached me, but I suspect it was obtained off the coast of Otago. The colour is uniform pale-brown. In size it is just double that described by Bell in 1881, having R. 30, r. 16; and the ratio is therefore—r. : R. = 1 : 1·87.

In form it is more distinctly a five-rayed star than Bell's figure, and resembles Ludwig's figure of *O. penicillatus* [29, pl. v, fig. 4]; but in the two specific characters on which Ludwig lays stress—viz., (1) the proportion of R. to r., and (2) the number of marginals—my specimen agrees with *O. grayi*. There are ten supramarginals on each side of the arm, the terminals being quite small; so that, with the interbrachial, there are twenty-one from tip to tip of the neighbouring arms. Most of the granules on these plates have been rubbed off, so the condition of those along the contiguous edges of the plates is not satisfactorily determinable; but the few that remain allow one to recognise that the suture would be readily seen—a feature which, according to Ludwig, is more or less characteristic of *O. penicillatus*, though he lays less stress on this character than on the two referred to above.

The abactinal plates on the arms exhibit a differentiation into median slightly larger plates, and lateral or intermediate plates. The abactinals cease at the level of the last three or four marginals, so that these are in contact across the arm (which, Ludwig states, is never the case in *O. penicillatus*).

I have in the Otago Museum a specimen which was obtained in 1900, which in form is more nearly pentagonal than that represented in Bell's figure, and more like Ludwig's figure (pl. v, fig. 6). In it the marginals are in a better state of preservation than in the "Nora Niven" specimen, and the marginal tubercles have distinctly this *penicillatus* arrangement—*i.e.*, a smooth groove is visible between contiguous marginals: the tubercles do not interdigitate over this groove. The abactinal plates are continued, in three arms, to the apex; in the other two arms the last pair of marginals meet dorsally.

The measurements in this specimen are R. 33, r. 21; and r. : R. = 1 : 1·57. The last feature is characteristic of *O. grayi*, and the existence of only eight marginals on each side is confirmatory, though the other two characters might point to *penicillatus*.

Locality.—[East of Otago Heads, 20–40 fathoms (O.U.M.).]

Remarks.—This little starfish is readily distinguished from *Asterodon miliaris*, apart from its smaller size, by the distinctly spinous character of the plates, and by the single glassy-tipped dental spine at each angle of the mouth.

The occurrence of this species in our waters is an extremely interesting geographical fact, as hitherto it has only been found in the Magellan Straits, off Tierra del Fuego, and at the Falkland Islands, in a depth of from 10 to 105 fathoms.

Asterodon miliaris, Gray.

Astrogonium rugosum Hutton, 1872.

Gnathaster miliaris Farquhar, Trans. N.Z. Inst., xxxix, 1906, p. 126.

In this paper Farquhar gives the earlier synonymy.

Stations 15, 16, 22, 26, 29.

I had, independently of Mr. Farquhar, arrived at the conclusion that Hutton's *A. rugosum* is identical with Gray's species, as a result of an examination of the type in the Dominion Museum, which Mr. Hamilton, the Director, was good enough to lend me for the purpose in March, 1907.

In placing it in the Archasteridæ instead of the Pentagonasteridæ I follow Bell, Bronn, Delage, and others. In deciding on its title to be placed in the genus *Asterodon* I am influenced by the following considerations: This family contains several sub-families, of which the Gnathasterinæ consist of starfishes with well-developed oral angles, which may bear one or two dental spines, glassy-tipped and aborally directed. There are, according to Delage, five genera: *Asterodon*, Perrier; *Odontaster*, Verrill; *Acodontaster*, Verrill; *Goniodon*, Perrier;

and *Hoplaster*, Perrier. The last may be omitted from the discussion; and both Bell [6] and Ludwig [29] regard *Acodontaster* as having no generic value. It is with some diffidence that I place our species in Perrier's genus *Asterodon*, for I have only Hamann's brief diagnosis [21] and Ludwig's figure of *Asterodon singularis* to enable me to arrive at this conclusion. Bell [6] quotes from Perrier's (1891) diagnosis of *Asterodon*, from which it appears that some species may have one dental spine on each angle, and some species two such spines; and he regards *Odontaster*, *Gnathaster*, and *Asterodon* as synonymous, the former having priority of nine years. But in 1894 Perrier established the genus *Goniodon* for the New Zealand *G. dilatatus*, which appears from the diagnosis in Bronn, &c., to differ from *Asterodon* and *Odontaster* only in the great dilatation of the marginals before their sudden decrease in size at the tip of the arm; but, as Loriol showed (1895), there are two dental spines at each oral angle. Ludwig (1905, p. 42) uses *Odontaster* for all those forms which possess only a single dental spine, and thus includes Verrill's *Acodontaster* and Sladen's *Gnathaster* as synonymous. In the same memoir Ludwig gives an excellent photogravure of the lower surface of *Asterodon singularis*, from which it appears that this genus has two dental spines: our species has these two spines, as Farquhar noted in 1897. Hence we may, as it appears, place our *miliaris* either in *Asterodon* or *Goniodon*;* but in order to include it in the latter genus it would be necessary to emend the diagnosis: I therefore prefer to adopt the other alternative. And, so far as I can judge, *Goniodon* is not worthy of generic distinction from *Asterodon*; but into that matter I am insufficiently equipped to enter.

Although *Asterodon miliaris* is quite abundant off our coasts, yet it has never received an adequate description, and the difficulty of placing it has arisen from the fact that Gray's type is so badly damaged in the neighbourhood of the mouth that Bell (1893, p. 262) was unable to ascertain whether it is armed with five or ten dental spines. I have sent specimens to the British Museum, so that we may look forward to an authoritative pronouncement as to its generic position in the near future.

General Description.

The general shape is known from Gray's figure. Form, a 5-rayed star, with large disc, short arms, and rounded concave interbrachial areas. The colour is a yellowish-brown. The abactinal plates have rounded platforms covered with small, short, rounded tubercles; the plates are slightly separated from one another by papular areas. Those plates along the median line of the rays are slightly larger than the rest, though this difference is more marked in some specimens than in others. This median row extends to the tip, and is separated

* W. K. Fisher, in Anat. Anz., 1908, p. 358, states that "*Goniodon* is invalidated by its earlier use for a mollusc"; and proposes *Diplodontias*, with *D. dilatatus* as type.

from the supramarginals, except the last three or four, by intermediate plates, of which there are at the base of the arms 4 or 5 longitudinal rows, or, in large specimens, even 6 or 7 such plates. The madreporite, which varies in size and shape, is situated about $\frac{1}{3}$ r. from the centre. The marginals are covered with small, short, rounded tubercles similar to those on the abactinal plates.

In each interbrachial area is an unpaired marginal plate, rather larger, as seen from above, than its immediate neighbours.

The marginals are approximately of equal size throughout the length of the row, but very gradually decrease towards the tip. The number of supramarginals varies with the size; the inframarginals agree in number with them. In the largest (R. = 76) there are 32 marginals from the tip of one arm to the tip of the next. In the smallest specimen measured (R. = 58) there are 24.

The actinal plates are in contact, there being no papulæ; they are more or less polygonal in outline, and bear tubercles of the same character as the abactinals. The number of plates in the interbrachial area varies with the size from 7 to 10 between the oral angle-piece and the inframarginal.

The adambulacrals carry 6 spines in 3 pairs (sometimes a fourth pair is present near the mouth): these are stout, cylindrical, or somewhat prismatic, with rounded ends; the innermost are the largest, and arch over the groove like the rafters of a roof; the outermost are shortest. These last are longer than the tubercles of the disc, and so stand up above the general level of the lower surface.

The oral angle bears a couple of long, cylindrical, glassy-tipped dental spines, directed aborally, and in all the specimens lie prone on the parent plate (see Farquhar, 1897, pl. xiv, fig. 6).

Localities.—Off the east coast of the South Island, between Otago Heads and Oamaru; depths, from 18–44 fathoms. It is confined to New Zealand, and apparently to the east coast and Cook Strait. [Farquhar has also noted it from Tasman Bay, Hawke's Bay, Cape Farewell; and specimens from Stewart Island are in the O.U. Museum.]

Variability.

It is somewhat variable in shape, owing to the greater or less amount of interbrachial excavation, so that the relative diameter of ray and disc varies; some individuals, also, are much flatter than others. The variations affect the following structures:—

(*a.*) The proportion of R. to r. (*i.e.*, of the length of the arm or ray to the length of the interbrachial region of the disc) is $\pm$ 2 : 1. In dried specimens it is usually less than 2; in alcoholic specimens more than 2. In a series of five dried ones the lowest proportion is R. : r. = 1·7 : 1, and the highest is 2·06 : 1. In alcoholic specimens, of which four were measured, the lowest is R. : r. = 2 : 1, and the highest is 2·29 : 1. This comparison also indicates that, in drying, the arms shrink more than do the interbrachial areas, which is the

reverse of what one would expect. The absolute diameters in millimeters range from R. 58, r. 30, to R. 72, r. 37, dry; and, in alcohol, R. 66, r. 33, to R. 76, r. 34. This variation results in slight differences in outline, the arms being longer or shorter, and the interbrachial less or more excavated.

(*b.*) The arms are sometimes narrow at the base, sometimes broader; in some cases more pointed, in others more rounded at the apex.

(*c.*) The number of supramarginal plates increases with the size: in the smallest (R. = 58) there are 10 supramarginals on each side of an arm, omitting the odd interbrachial plate; the highest number is 16, in a specimen in which R. = 76 mm.

(*d.*) The madreporite is in some but little larger than a neighbouring abactinal plate; in other cases, more than twice the size: it may be circular, or irregularly pentagonal. In the largest individual it measures 10 mm. in diameter.

Pentagonaster pulchellus Gray.

Astrogonium pulchellum Sladen, 1889. Farquhar, Proc. Linn. Soc. N.S.W., xxiii, 1898, p. 310.*

Station 29.

A single specimen was obtained off Oamaru.

R. 40, r. 25 (which is smaller than some other specimens in this Museum, one of which has R. 50, r. 30).

It has the swollen marginals at the ends of the arms, typical of the species, the tip of the arm measuring 15 mm. across.

The abactinal plates are flat, except along the middle of each arm, where each is slightly convex.

Although this species has usually been referred to the genus *Astrogonium* Müller and Troschel (1842), yet, as Verrill (1899) pointed out, Gray (1840) had already placed the species in the genus *Pentagonaster*, of which it stands as the geno-type.

This species is described and figured by Gray [20, p. 11, pl. viii, fig. 3.]

Localities. — Off Oamaru, at a depth of 25–30 fathoms, shell gravel. [Foveaux Strait, Cook Strait, Chatham Islands (F.).]

Pentagonaster abnormalis Gray.

Astrogonium abnormale, auct. Farquhar, *loc. cit.*, 1898, p. 310, for synonymy.

Plate VIII, fig. 5.

Stations 15, 16, 22.

This is a common species off the east coast of Otago, for, in addition to the ten specimens obtained by the "Nora Niven" between Otago

* Instead of repeating under each species its full synonymy and references it will suffice to refer to this paper of Mr. Farquhar's.

Heads and Oamaru, at depths of 18 to 44 fathoms, a considerable number were obtained by me in 1899 during trips in s.s. "Doto" and "Plucky" in the same locality. [Also, Nelson, Wellington (F.); Pegasus Bay, and Stewart Island (O.U.M.).]

It was first recorded from New Zealand by Hutton (1872), who refers to a form in the Dominion Museum, Wellington, which differs from *P. pulchellus* in having the apical plates of the arm "very little swollen." He called it "var. B." Farquhar (1895, p. 200) refers to the same specimen, and gives a description of another one obtained by a fisherman at the Bluff. In 1897 he suggested (p. 195) the possibility that this "var. B." is the "*Astrogonium abnormale*" described and figured by Gray [20, pl. viii, figs. 1, 2], the locality of which was unknown. Farquhar [16], in his List of New Zealand Echinoderms, definitely identifies it with Gray's species.

The species presents a good deal of variation, which affects (*a*) the number of supramarginal plates, (*b*) the character of the abactinal plates, which are sometimes quite flat, at other times distinctly convex and even mammilliform, especially along the median line of the rays; (*c*) but the most interesting variation is that which is presented by the supramarginal plates at the apex of the arm, for in some instances these are sufficiently enlarged as to approach the condition which characterizes *P. pulchellus*, and which alone distinguishes that species from *P. abnormalis*.

From an examination of a series of about twenty individuals, I am inclined to think that the rarer *P. pulchellus* is merely a very abnormal variation of the common *P. abnormalis*, but for the present I leave this open, for there is a distinct gap in my series between the most swollen plates of *P. abnormalis* and those of *P. pulchellus*.

Mediaster sladeni, sp. nov.

Plate VII, figs. 1–5.

Station 29.

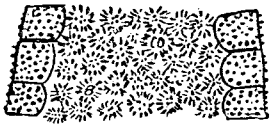
A single specimen, dried; pale buff-brown. The general outline is not unlike that of *A. miliaris*.

Measurements: R. 75, r. 35. r : R = 1 : 2·14.

The upper surface is formed of round-topped subcircular plates bearing numerous rounded tubercles, the plates being separated by papular areas. The large disc plates support a marginal series or circle of sixteen to eighteen more or less prismatic tubercles of unequal thickness, surrounding a circle of eight or ten similar but smaller ones, and, centrally, one, two, or three others, according to whether the plate itself is circular or oval in shape.

These plates are continued on to the rays, where they are rather smaller than on the disc; and as the tip is approached the tubercles become shorter, and the tabulæ more convex, so as to appear almost hemispherical.

PLATE VII.



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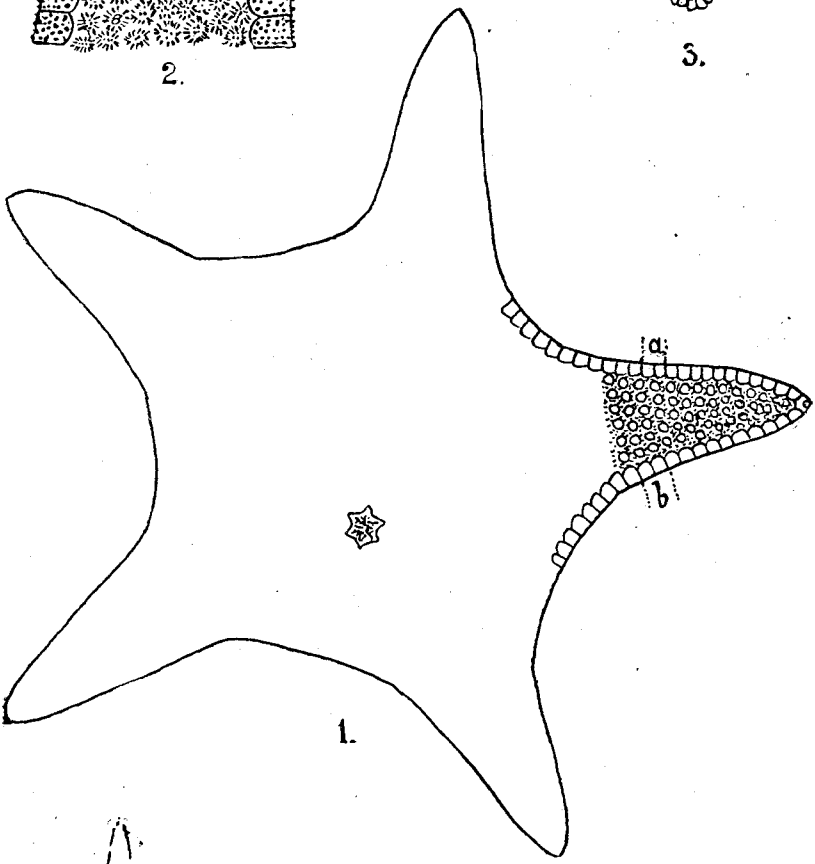

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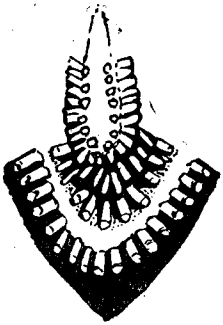

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4.

The supramarginals, of which there are 50 from the tip of one arm to the tip of the next (or twenty-five on each side of an arm), diminish in breadth as the apex is approached, but less markedly so than in *M. arcuatus* Sladen. The breadth now exceeds the length.

Valvate pedicellariæ are few, but in fair number irregularly scattered on the abactinal surface. The madreporite is rather large, about $2\frac{1}{2}$ times the diameter of the neighbouring plates; is six-rayed; and lies near the centre of the disc, from which it is separated by its own diameter, whilst it is about six of its diameters from the margin.

The marginals are covered with low rounded tubercles, of which those on the edges of the plates are rather larger (not smaller as in *M. arcuatus*) than those on the face.

A few large valvate pedicellariæ occur on the supramarginals, varying in number on the five "sides" of the starfish (*i.e.*, between tip and tip of the two arms): on two sides, none; on the third side, 1; on the fourth side, 3; on the fifth side, 5. The inframarginals alternate with the supramarginals, except the odd interbrachial plate, and sometimes the one on each side of it. I see no pedicellariæ on these plates.

The adambulacrals carry 4 longitudinal rows of stout, prismatic, round-topped spines; the innermost row, overhanging the groove, consists of 4 or 5 spines: if the former, one is much stouter than the other three. They stand closely side by side, looking like a thick-toothed comb, and have brown tips. The second row contains 3 or 4, the third only 3 spines. The 3 or 4 of the outermost row are, as usual, much smaller than the preceding, and only a little larger than those on the actinal plates. Sometimes this row is irregular, so that an imperfect fifth row is apparently present.

The angle of the mouth bears on the margin about 16 to 18 stout prismatic spines, similar to and of the same length as the innermost adambulacrals, directed towards the centre. On the actinal surface of each of the angle-pieces is a row of 6 or 7 similar but rather smaller spines, like those of the second row but slightly stouter; and also a few small tubercles are present. The actinal plates are continued from the interbrachial areas along the arm to the level of the fifth or fourth marginal from the tip. All these plates are similar to those on the upper surface, and I see no pedicellariæ.

Locality.—Off Oamaru, on shell gravel, at a depth of 25–30 fathoms.

Remarks.—The leading difference between this starfish and *Asterodon miliaris*, to which it bears a considerable superficial resemblance, is in the character of the oral armature; for, in place of the two reflexed dental spines at each oral angle, this species bears a number of small spines similar to those of the adambulacrals.

I have had access only to Sladen's description of *M. arcuatus*, of which a single individual was during the "Challenger" expedi-

tion obtained from the Japan Sea. From it mine differs chiefly in numerical proportions—(*a*) size, (*b*) number of adambulacral spines, (*c*) number of oral spines, (*d*) number of spines on the abactinal plates, (*e*) number of marginals, &c. Several other species have since been described, from the eastern shores of the Pacific, but I am unable to make any comparisons with them.

Asterina regularis, Verrill.

Farquhar, *loc. cit.*, 1898, p. 312, for synonymy.

Specimens were obtained at several stations. It is by far the commonest of the littoral starfishes on, at any rate, the South Island, and Mr. Farquhar has published some interesting notes on it [15].

Localities.—Coast of Otago [and generally round the South Island, and Wellington].

Stichaster polyplax Muller and Troschel.

Tarsaster neozealanicus Farquhar, 1895. Farquhar, *loc. cit.*, 1898, p. 313.

A single small specimen was collected, but was without indication of station when it reached me. It is fairly common on the shores of both Islands, having been recorded from Auckland, Wellington, Nelson, Sumner, Otago, as well as from the Chatham Islands.

Stichaster insignis Farquhar.

Farquhar, *loc. cit.*, p. 314, for synonymy.

Stations 24, 29.

Two bright-red starfishes, which I refer to this species, differ slightly from one another and from the account of the species given by Farquhar in 1895.

In the first place they are considerably larger. One of them, with six arms, has R. 88, r. 12 mm.; r. : R. = 1 : 6·33, with the greatest width of arm 18 mm., which is at a short distance from the base. I cannot detect any definite madreporite, though at two spots the abactinal plates are crowded.

The other, with five arms, one of which has evidently been regenerated, measures R. 71, r. 7 mm.; so that r. : R. = 1 : 10·14. This one shows the characteristic four madreporites, though the spines on the abactinal surface are less numerous than in typical specimens in this Museum. In the larger specimen the arrangement of plates and spines agrees with these individuals which I received from Mr. Farquhar.

The greater size of the specimens may be related to the greater depth at which they were obtained.

Localities.—Off the east coast of Otago, on sand, shell, and gravel, 18 to 38 fathoms.* [Taylor's Mistake; Wellington (F.).]

Echinaster farquhari, sp. nov.

Plate VIII, figs. 1–4.

Station 15.

A single specimen; in a dried state orange in colour when first received, but is now faded. It measures R. 55, r. 13 mm.—thus R. $>$ 4 r.; breadth of arm, 17 mm. The five arms are blunt at the tips, which are upturned; the base of each is somewhat swollen, so that a well-marked interradial furrow traverses the disc for nearly half its radius.

The madreporite, which is situated about midway between the centre and margin, is circular, very prominent, projecting above the general surface; is coarsely furrowed, and not surrounded by spines.

The abactinal skeleton consists of an irregular network of short ossicles leaving larger and smaller meshes: the former are often partially occupied by small irregular ossicles, which nearly subdivide the mesh. On the disc the meshes are smaller, the main ossicles being closer together than on the arms. In the larger meshes on the latter some 6 or 8 papulæ occur; on the smaller, only a single papula.

On the abactinal surface of the disc spines are practically absent, and are few and widely scattered on the upper surface of the arm. Here and there an isolated, short, blunt, apparently immovable spine springs from a node in the network; they become relatively more numerous, but still few and widely spaced, as the tip of the arm is approached. At the sides of the arm, however, they are more definitely arranged, as also are the ossicles.

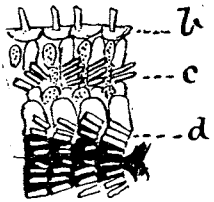
I see no pedicellariæ anywhere.

The ambulacral grooves are very narrow and deep, the podia being, of course, in two series; the groove is concealed by adambulacral spines, which are long enough to reach across it. Each adambulacral ossicle carries 4 stout, nearly cylindrical, blunt spines, arranged in a transverse row in regard to the groove. The innermost is rather shorter than the next, which is the stoutest and longest of

* During the examination of these specimens I endeavoured to trace the starfish which Hutton identified as *Uniophora granifera* (Trans. N.Z. Inst., xi (1878), 306), and which was at that time in the Otago Museum. I failed to find any that agrees with Muller and Troschel's description and figure, and I have come to the conclusion that Hutton must have been mistaken in his identification; perhaps he confused it with *Stichaster australis*, especially as the above authors, in a footnote (p. 20), state that *Uniophora* includes species which they had formerly placed in that genus. I communicated with Mr. Farquhar asking him whether he had ever met with the species; he replied that he had not, and that he had likewise come to the conclusion that the genus had been included in our list in error.

PLATE VIII.

2.



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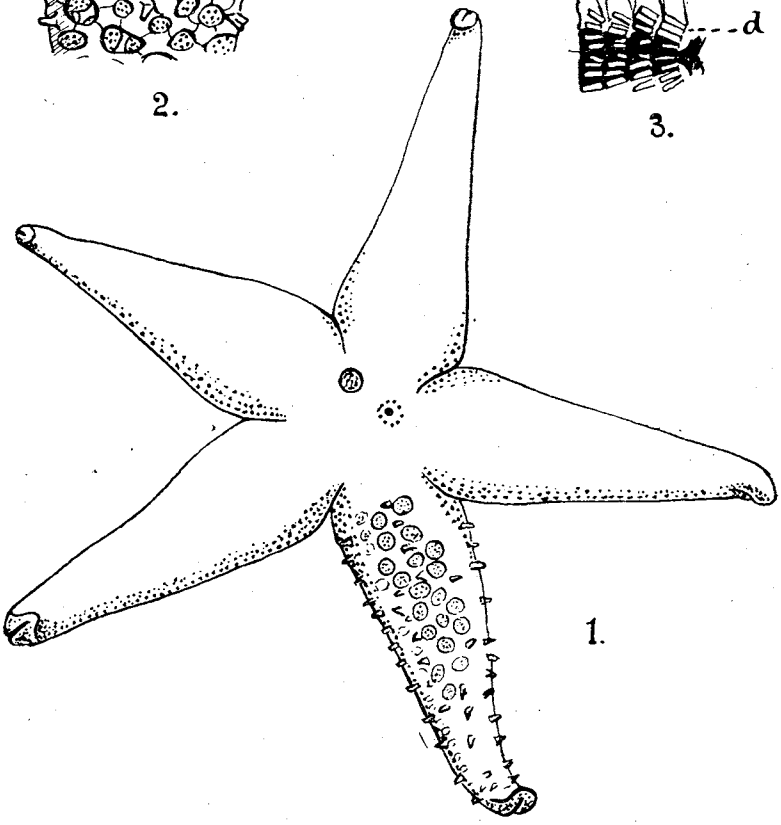

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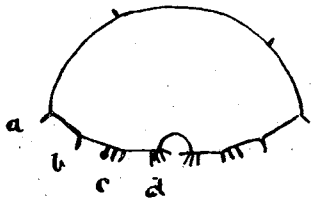

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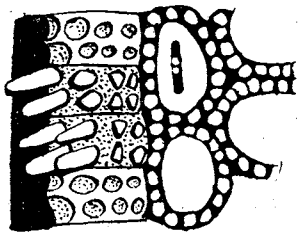


5.

the four. This innermost springs from the edge of the plate and extends almost horizontally across the groove; the remainder project vertically and are divergent.

Outside the adambulacrals is a continuous series of small intermediate ossicles, each with a spine somewhat smaller than the adambulacrals: these intermediates are present for only about half-way along the arm. Outside these is a row of rather closely set, vertically elongated ossicles (figs. 3, 4, *c*), separated from one another by a papular space. These ossicles are connected at their upper ends by a series of horizontal, slightly keeled ossicles (*b*), which gives rise to a continuous slight ridge along the ventral margin of the arm, as seen from below. These vertical ossicles bear groups of spines, each group consisting of 2, 3, or 4 spines, shorter than the adambulacrals, disposed vertically above one another. Above these ossicles again there is another row of vertical ones, succeeded by a second ridge formed of horizontally arranged ossicles (*a*), which form the lower margin of the curved edge of the arms, as seen from above. (*Cf.* transverse section of arm, fig. 4.) This ridge bears pairs of spines of the same size as those of the lower ridge. Above the second ridge the irregular network of the abactinal surface commences—somewhat denser at the sides, looser above, with rare, isolated spines.

Locality.—Off Otago Heads, 18–38 fathoms.

Remarks.—This species is very different from *E. purpureus*, of which there is a specimen in this Museum. It is not unlike *E. eridanella* M. and T., from the Admiralty Islands and Thursday Island; but this seems to have constantly six arms and two madreporites, according to Perrier (Ann. Sci. Nat. Zool. (5), xii, p. 250).

Asterias calamaria Gray.

Farquhar, *loc. cit.*, 1898.

Stations 16, 20.

This, one of our commonest long-armed, many-rayed littoral starfishes, was obtained only at two stations off the east coast of Otago. Sladen (1889, p. 563), placed this and the following species in his sub-genus *Stolasterias*, characterized by the definitely arranged spinelets, large and isolated, surrounded by dense wreaths of pedicellariæ. But in 1867, Verrill [37] had described the species under the name of *Coscinasterias muricata*, which he did not then recognise as being Gray's *A. calamaria*. Verrill's generic or subgeneric name ought, then, to have precedence of Sladen's so far as this species is concerned (see Fisher, 1906, A.M.N. Hist. (7), xvii, p. 574). But I have preferred to leave both the species under the generic title of *Asterias*. Various other subgeneric names have been proposed by Perrier; but even Hamann [21] omits them in his lists.

Mr. Farquhar [14 and 16] has given a valuable and interesting account of certain bionomic facts relating to this species.

Asterias mollis Hutton.

Farquhar, *loc. cit.*, 1898, p. 316.

Stations 9, 16.

This species was obtained off the east coast of Otago. It does not appear to be so widely distributed as the preceding. Farquhar refers only to Lyttelton as its provenance, but it occurs, though not very abundantly, at Dunedin.

OPHIUROIDEA.

Ophiomyxa australis Muller and Troschel.

Farquhar, *loc. cit.*, 1898, p. 309.

This is a very common denizen of the rock-pools of the southern portion of New Zealand; indeed, it appears to be the commonest of our ophiurids. It has, too, a very wide distribution outside the limits of our area. (See also Farquhar [18].)

Astrotoma waitei, sp. nov.

Plate IX, figs. 1–6.

Stations 15, 16, 22.

Astrotoma is one of the few genera in which the arms can be rolled inwards towards the mouth; and these arms are unbranched.

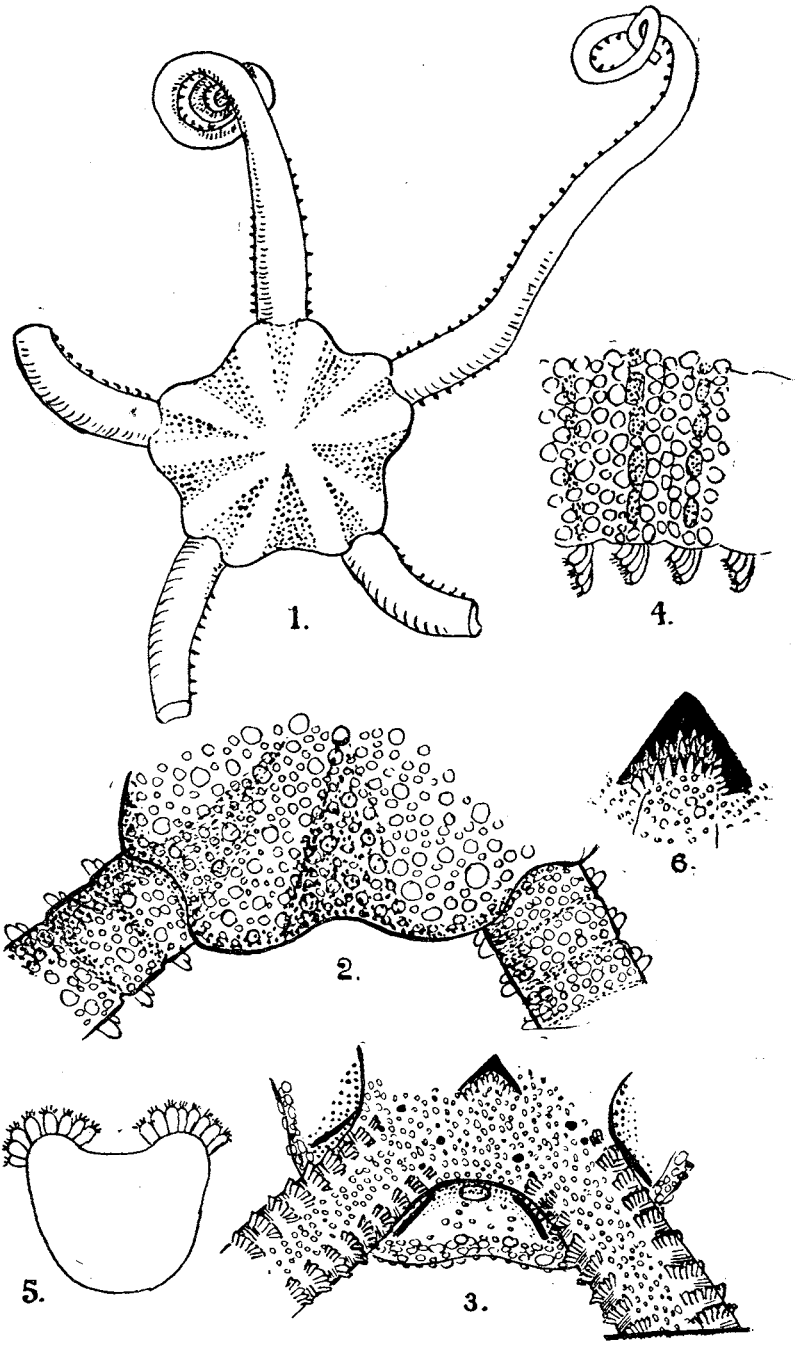
This is the first recorded occurrence of the genus in New Zealand waters. Three specimens were received by me; when dried they are a dirty white in colour.

The diameter of the disc is 33 mm.; the height in the centre is 20 mm.; the length of the arm is ± 130 mm.; the width of the arm at base is 9 mm.; height of the arm is 7 mm. As the tips of the arms were more or less coiled, it is difficult to determine accurately their lengths; but the above is an approximation.

The upper surface of the disc is covered by closely set, rounded scales of two chief sizes, though others of intermediate size occur; the smaller ones filling the gaps between the larger, which are about 1 mm. in diameter. They have no definite arrangement. In the interbrachial spaces the small ones decrease in size as the margin is approached, and here the larger ones become fewer, so that the intergenital areas are finely granulated, the granules being rather more inclined to be spinous than elsewhere. The adradial plates, which are about 5 mm. broad near the edge of the disc, and are covered by the scales, form marked ridges extending to the centre of the disc, which is, in the dried specimens at any rate, slightly raised above the general surface.

The actinal or oral surface is tesselated with closely set, flattened, and nearly uniform granules, smaller than those on the lower surface of the arms.

PLATE IX.



The mouth-angles are covered with even smaller scales; each carries near its apex several long conical spines, which are not confined to the apex, but extend along the sides of the mouth-angles, and also within the buccal cavity, in two or three tiers, so as to appear almost like buccal or oral papillæ. They are more numerous and more slender than the tooth papillæ of *Astrotoma agassizii* Lyman.

A small oval madreporite lies at the edge of the horizontal circumoral region, just below the ridge or fold connecting two neighbouring arms, and which separates the intergenital area from the oral area. It measures 1·5 mm. in length which is horizontal or tangential, and 1 mm. in length which is vertical or radial. The genital clefts are 4 mm. in length—two in each interbrachial space.

The arms are high, strongly arched abactinally and flattened below, tapering gradually; and the ends are coiled, to a greater or less degree, in all the specimens. The sides and upper surface are covered with granulated scales, and in the dried specimens the skin is depressed between the vertebral ossicles, so that the arm appears segmented—that is, it is surrounded by narrow grooves alternating with broader raised areas: in the grooves the scales are not perceptibly smaller than elsewhere. On each side of the arm, on each of the raised areas, there are about twelve groups of minute glassy hooklets, forming an interrupted ring round the lateral and upper surfaces of the arm; each group is borne on a flattish plate, a little sunken, surrounded by a more or less evident circle of the larger granules of the skin.

The under-surface of the arm is covered by uniform rounded granules, rather larger than those on the under-surface of the disc, but smaller than those on the sides of the arm. Each "segment" of the arm carries 8–10 short, cylindrical, blunt spines, terminating in a tuft of glassy spicules, so that the tips are distinctly rough. At about three-quarters of the length of the arm they begin to decrease in number, till only 1 or 2 long, slender, clawlike spines remain: this reduction is effected by the disappearance of the spines outside or above the pore.

It is clear that these claws, as well as the roughened tips of the spine, serve admirably for grasping objects round which the arms may be coiled; and it happens that in most of the specimens these hooks have been broken away on removing the animals from the net in which they were captured. These "arm spines" or "tentacle spines" are set on a granulated ridge.

The tentacle pore is on a level with the third spine from below, so that there are from 5–7 spines above, or outside, the pore. The first tentacle pore, situated on the disc, is without a spine; the second, which is on the base of the arm, just where it joins the disc, is provided with 3 or 4 spines; the third pore has 5 spines on a ridge; the next, 6 or 7, and the full number is soon attained.

Locality.—East coast of Otago.

Remarks.—Only four species of *Astrotoma* have hitherto been described: *A. murrayi* Lyman, 1882, obtained by the "Challenger" at Banda Islands, 200 fathoms; *A. agassizii* Lyman, 1875, from the Straits of Magellan, 135 fathoms: from both of which our species differs in various respects. The descriptions of *A. bellator* Koehler, and *A. vecors* Koehler, got during the "Siboga" expedition (1904) from the Sulu Archipelago and Banda Sea respectively, are not accessible to me, so it may turn out that ours is synonymous with one of them.

Amphiura noræ, sp. nov.

Plate X, figs. 1–3.

Station 83.

The colour of the solitary specimen is, in alcohol, and later when dried, pale greenish-grey, with whitish arms. The disc, which is 9 mm. in diameter, is deeply notched interbrachially. The arms are more than 45 mm. in length (the tips are broken); each is about 1·5 mm. across the base. The upper surface is covered with small, flat, round, overlapping scales; a central and 5 radially situated scales, a little distance from the centre, are circular and distinctly larger than the rest. The scales decrease in size towards the margin, though those immediately bordering the adradial plates are rather larger than their neighbours.

The adradials are narrow, convex externally, slightly concave internally, extend about half-way towards the centre of the disc, and do not quite reach the margin. They measure 2 mm. in breadth by 5 mm. in length. The two adradials of a pair are separated by a row of 3 long plates, and their proximal ends by 2 or 3 rounded ones.

The mouth-shields are somewhat oval, with the slightly longer axis radial. The proximal margin is slightly peaked; the distal convex, with two very slight notches dividing the margin into three nearly equal portions, of which the middle is rather more pronounced.

The side mouth-plates are broader distally than orally where they touch; the lateral margin is slightly excavated.

There are 3 buccal papillæ on each side of each mouth-angle—one at the apex of each jawpiece forming the angle, a second smaller one laterally, while the third is very large, oval, and plate-like, nearly as long as the side mouth-plate, and resembling a "tentacle scale."

The actinal interbrachial area is almost naked; there is at the margin a very narrow band of small scales, continuous with those of the upper surface of the disc, another narrow band along the side of each genital cleft, and a few small, isolated scales in the intergenital area. This naked interbrachial area, and the presence of the middle of the three buccal papillæ, serve to distinguish this species from *A. rosea* Farquhar [13], to which it bears, otherwise, a general resemblance.

The upper arm-plates are transversely oval, with a slight peak in the middle of the distal border; between them the side arm-plates are visible reaching nearly to the middle line. The under arm-plates are approximately square, nearly as broad as they are long, with the lateral and distal margins slightly excavated, and the proximal slightly produced and angulated. The side arm-plates support four comparatively long, slender, pointed, conical arm-spines, the second of which is longest, and the uppermost the shortest. Further along the arm the upper one disappears.

Locality.—Off Cape Kidnappers, east coast of the North Island.

Remarks.—This species seems to be near *A. koreæ* Duncan [12], in which, however, the intergenital area is plated.

Ophionereis schayeri Muller and Troschel.

Farquhar, *loc. cit.*, 1898, p. 307.

A few specimens of this very common littoral species were included. It appears to be distributed all along our coast. (See remarks by Farquhar [18].)

Ophiactis nomentis Farquhar.

Ophiactis nomentis Farquhar, Trans. N.Z. Inst., xxxix, 1906, p. 125.

Unfortunately the station-number of this species is not recorded. It was obtained by Farquhar in 4 fathoms of water at Cape Maria van Diemen, but our specimens must have been got south of this, and on a sandy bottom, for sand still adheres to them. Their colour is now grey, mottled with white, especially on lateral portions of the upper arm-plates.

Pectinura maculata Verrill.

Farquhar, *loc. cit.*, 1898, p. 306, gives synonymy. Koehler, Bull. Sci. de la France, xli, 1907, p. 285, pl. x, fig. 34.

Stations 6, 9, 15, 24.

This handsome and not uncommon species, described so long ago as 1869, has only recently been figured by Koehler.

Localities.—Stewart Island, south and east coast of South Island. [D'Urville Island, in Cook Strait; Wellington; Auckland; Chatham Islands (Farquhar).]

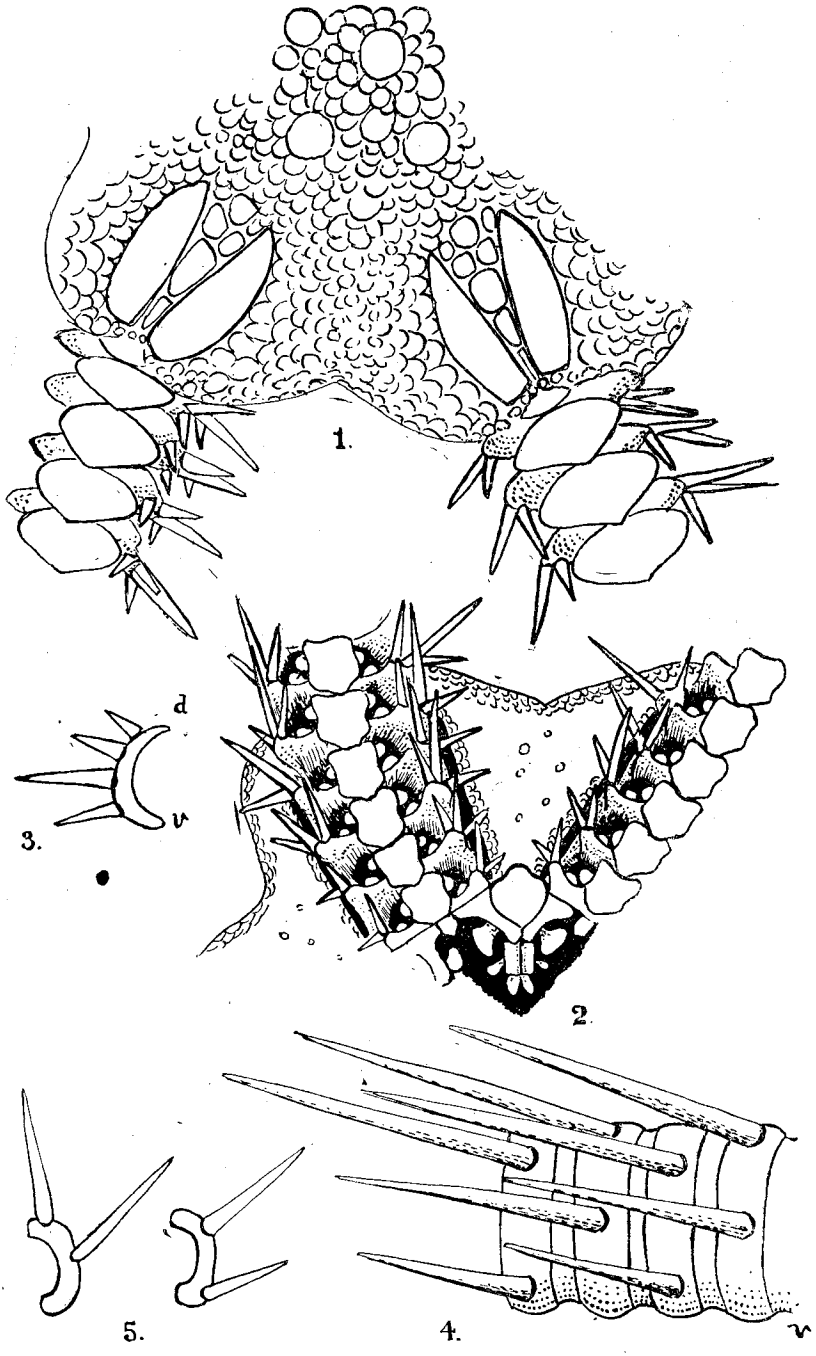
ECHINOIDEA.

Goniocidaris umbraculum Hutton.

Farquhar, *loc. cit.*, 1898, p. 316.

Several examples of this curious little cidaris were obtained. The characteristic spines, dilated at the tip to form a flattened or concave terminal disc, are unmistakable. Hitherto it has only been obtained from the shores of Stewart Island, and doubtless these present specimens came from that neighbourhood.

PLATE X.



Porocidaris elegans Agassiz.

Porocidaris elegans Agissiz, Proc. Amer. Acad., xiv, 1879, p. 198; "Challenger" Reports, iii, 1881, p. 40.

Histocidaris elegans Mortensen, Danish Ingolf Exped. 1903, pp. 21, 30.

Stations 83, 89.

This little cidarid has hitherto been obtained off Sydney and the Philippines, and its discovery in considerable numbers off New Zealand has much interest.

The only difference that I can detect, from the abbreviated account in the "Challenger" report (for I have not access to the earlier description), is the fact that there is in our specimens no crenulation on the boss of the tubercles. Wyville Thomson [36] pointed out, and Agassiz gives further evidence, that cases are known in which some individuals of a species usually having crenulated tubercles have smooth bosses. Also, both in *P. purpurata* Thomson and *P. elegans*, only some of the tubercles exhibit this feature. As our specimens are all smaller than those obtained by the "Challenger," their absence may be due to immaturity. In all other respects, however, the agreement is so close that I do not feel justified in making a new species.

This little cidarid is readily distinguished from our other member of the family, not only by the greater length and delicacy of the spines, the length of which is 2 to 3 times the diameter of the corona, but by the peculiar flattened pectinate spines around the mouth. Our specimens are smaller than those described by Agassiz. Height, 10 mm.; diameter, 19 mm.; plates, 6 in a vertical row.

I have followed Agassiz in rejecting Mortensen's generic name.

Localities.—Cape Kidnappers, 76–82 fathoms, soft mud; Cape Runaway, 105 fathoms, sand and mud: both on the east coast of the North Island.

Echinus angulosus Leske.

Farquhar, *loc. cit.*, 1898, p. 319.

Parechinus angulosus Mortensen, *loc. cit.*, 1903, p. 108.

Plate XI, fig. 5.

Station 29.

There are two specimens of an echinid which I attribute, with some hesitation, to this species, for the following reasons: (*a.*) The species is already recorded from New Zealand by Agassiz (1872, p. 490). (*b.*) There are several examples from Stewart Island in this Museum, so labelled by Captain Hutton. (*c.*) There is a fairly close resemblance between them and the photograph of *Echinus angulosus* given in Agassiz's "Revision," pl. vii *a*.

At the same time I feel doubtful as to the correctness of this identification, for—(1.) A detailed comparison with Agassiz's account of the arrangement of the tubercles in *E. angulosus* shows several differences;

indeed, the figure recalls that of *E. albocinctus*, but the colour of the test is quite different. (2.) The measurements do not yield the same proportions as those given by Agassiz, in which the number of interambulacral tubercles in a vertical row is less for a given height, and the spines are rather larger for a given diameter, than in our specimens. (3.) Filhol (1885) states, on the authority of Perrier, that the common *Echinus* which he collected on Stewart Island and in Cook Strait is *E. margaritaceus*, and makes no mention of *E. angulosus*.

Unfortunately I have not access to any detailed account of the former, but Agassiz refers (p. 493) to the large pedicellariæ and large miliaries as being characteristic; he also states that the primary spines are white and the secondaries yellow; while the photographs given by Agassiz and Pourtates (1874) show a very different type of tuberculation. Hence I conclude that our specimens are not *E. margaritaceus*. Moreover, Koehler's *E. antarcticus* (1901)—which Mortensen has suggested may be a synonym of *E. margaritaceus*—has a distinct centro-dorsal surrounded by quite small periproct plates; the coronal plates are few and high; and the general appearance and details are different. As Mortensen made the above suggestion (although disallowed by Loriol), there must be similarities between the two species, and, if so, it is evident that our urchin is not *E. margaritaceus*. At the same time it is curious that this species, which Filhol found so common, is not represented in any of our museums here.

In view of this doubt, and as no description of our *E. angulosus* has appeared in publications readily accessible to naturalists in New Zealand, I give the following brief account.

Measurements were taken of our largest and smallest denuded individuals.

	A, 25 interambulacral tubercles.	B, 18 tubercles.
	Mm.	Mm.
Diameter	42 ..	30
Height	27 ..	18
Width of abactinal area ..	7 ..	6
,, actinal area.. ..	13·5 ..	11
,, poriferous zone ..	3·3 ..	2
Spines (longest)	6–8 ..	5–7

The poriferous zone was measured at the ambitus. The largest tubercles are below the ambitus.

The colour of the (dried) test is a light greenish-grey with pale-brown poriferous zone, and a line of the same tint in the middle of each ambulacrum; the spines are pale-green, tipped with white; those around the mouth in recently obtained specimens are very pale violet below the tips; the secondary spines are olive brown.

In the interambulacral area each plate bears a moderately large tubercle, outside which are two smaller tubercles in a horizontal row; or in plates near the ambitus two rows of such tubercles, and on the inner side a single tubercle of about the same size. The arrangement

reminds one of that occurring in *E. albocinctus*. The miliaries are not very numerous, and are somewhat large.

In the ambulacral area each plate bears a single tubercle only a little smaller than those of the main vertical row in the interambulacrum, and throughout the greater part of the area there is a smaller tubercle on the inner side ; those in the poriferous zone are quite small.

Poriferous zone narrow ; pores trigeminate, in short curved rows, wider than in *E. albocinctus*.

In the apical ring none, or only one, of the oculars in our specimens reach the periproct, the external plates of which are rather large, centrals small. The genital plates bear 3 or 4 tubercles in a row near the inner margin, which are not much smaller than small ones in the neighbouring interambulacra.

The peristomial area is naked, except for small buccal plates close to the mouth.

Locality.—Off Oamaru, 25–35 fathoms. [Stewart Island, Dunedin (O.U.M.) ; Cape Campbell, Kaikoura (Farquhar).]

Echinus albocinctus Hutton.

Echinus albocinctus Hutton, 1872, Cat. Ech. N.Z., p. 12.

Echinus magellanicus Hutton, 1876, non Philippi ; Farquhar, *loc. cit.*, 1898, p. 320.

Pseudechinus albocinctus Mortensen, 1903, p. 106.

Echinus albocinctus Loriol, 1904, p. 18, pl. i.

Pseudechinus albocinctus Benham, Ann. Mag. Nat. Hist. (8), i, 1908, p. 107.

Stations 22, 24.

Eight specimens of this brightly coloured urchin were obtained off Shag Point and Moeraki, at depths of 20–40 fathoms, in a bottom of fine sand. [Also Stewart Island (O.U.M.).]

In the present article I have refrained from using Mortensen's generic names, for I gather from an abstract from Agassiz's introduction to his account of Panamic Deep-sea Echini (kindly made for me by Mr. Farquhar) that he is unable to accept them, owing to the insufficient basis on which they are founded, and that other echinologists also hesitate to use them.

Echinus huttoni Benham.

Salmacis globator Hutton, 1878, non Agassiz.

Pseudechinus huttoni Benham, Ann. Mag. Nat. Hist. (8), i, 1908, p. 104.

Stations 15, 16, 22, 24.

Five individuals of this species, which has for so long been known but has been concealed under an erroneous pseudonym, were obtained off Otago Heads, Shag Point, and Moeraki, at depths of 18–44 fathoms, on a bottom of fine sand. [Also Stewart Island, Preservation Inlet (O.U.M.).]

Arachnoides placenta Linnæus.

Farquhar, *loc. cit.*, 1898, p. 321.

This "cake-urchin," or, rather, "biscuit-urchin," is common on sandy beaches. Only one specimen was received, without indications of locality; but, as it is widely distributed, this omission is immaterial.

Echinocardium australe Gray.

Farquhar, *loc. cit.*, 1898, p. 322.

Station 30.

Only three individuals were preserved; they are quite immature. Probably, living as they do imbedded in the sand, the trawl missed many other specimens, for they must be fairly abundant.

Localities.—Off Oamaru. [It is very common round the South Island. It would be interesting to ascertain how far north it occurs.]

HOLOTHUROIDEA.

Phyllophorus longidentis Hutton.

Thyone longidentis Hutton, Cat. Ech. N.Z., 1872, p. 16.

Phyllophorus longidentis, Dendy and Hindle, Journ. Linn. Soc. (Zool.), xxx, 1907, p. 101, gives literature and synonyms.

Station 95.

One complete small individual and many, more or less digested, specimens were obtained from the stomach of the fish *Pagrosomus*. This suggests the desirability of examining the contents of various species of ground-feeding fishes for these and other mud-loving animals.

Locality.—Off Whale Island, Bay of Plenty, 25–34 fathoms, sand and mud.

Caudina chilensis J. Muller.

Caudina coriacea Hutton, 1872; Dendy and Hindle, *loc. cit.*, 1907, p. 108.

Caudina chilensis, Clark, Smithsonian Contributions, xxx, 1907, p. 175 (full synonymy).

Station 7.

A single specimen.

Locality.—South of Chasland's, 43 fathoms, fine sand.

Dr. Lyman Clark, in "Apodous Holothurians," 1907, p. 175, states that the specific name "*chilensis*" has priority over "*coriacea*." The species also occurs off Chili, Australia, East Indies, China, and Japan.

Molpadia marenzelleri Théel.

Ankyroderma marenzelleri Théel, "Challenger" Reports, xiv, 1886, p. 41, pl. iii, fig. 1.

Molpadia marenzelleri, Clark, Smithsonian Contributions, xxx, 1907, p. 171, pl. xi, fig. 4.

Station 83 (?)

Only one specimen of this rare deep-sea species was received by me.

The ovoid body is speckled with pale-red dots, due to the coloured phosphatic bodies in the skin; the body towards the posterior end is abruptly narrowed and prolonged backwards as a white tail.

The total length is 28 mm., of which the tail occupies 7 mm.; the greatest breadth of the body is 18 mm.

The only essential difference between this and Théel's type specimen, which was imperfect, and was captured off the East Cape at a depth of 700 fathoms, appears to be that the majority of the calcareous plates (or "tables") present only 3 or 4 perforations instead of 6.

Locality.—Cape Kidnappers, 68–78 fathoms, soft mud.*

Clark (see pp. 17–21) goes fully into the reasons for merging both *Ankyroderma* and *Trochostoma* in Cuvier's genus *Molpadia*. On page 143 the chemical analysis of the curious coloured bodies in the skin is given: they consist chiefly of phosphate of iron, with a little lime, and perhaps magnesium.

Molpadia dendyi sp. nov.

Plate XI, figs. 1–3.

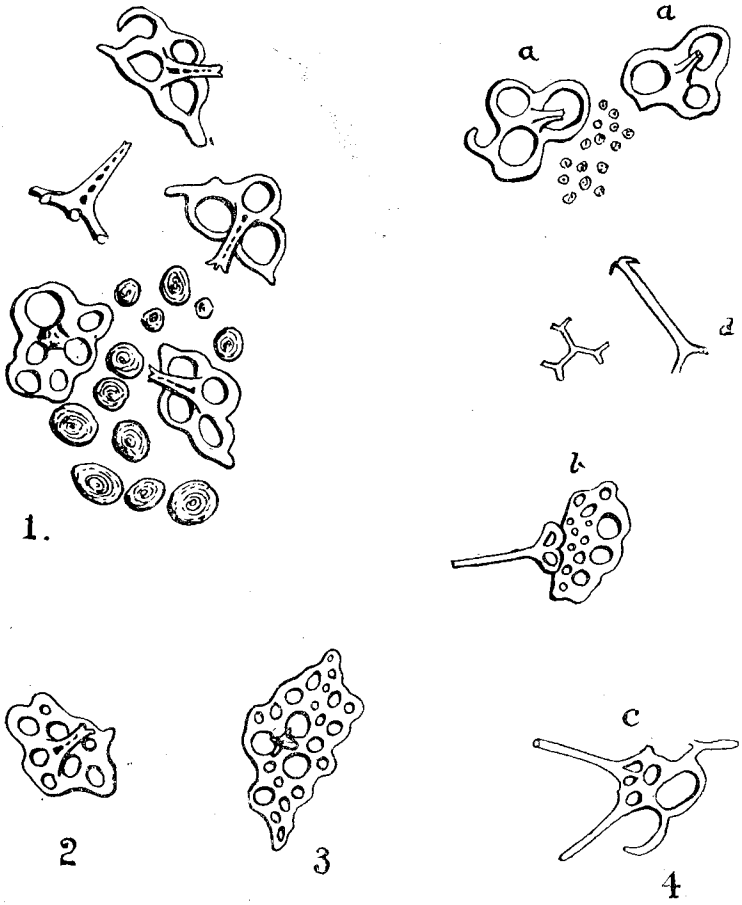
A single specimen; colour, deep maroon-red with a purplish tinge. Length, 65 mm., of which the white tail measures 15 mm.; diameter of body, which is rather shrunken, is 20 mm.; the tail is 2 mm. across. The oral region, which was not retracted, measures 4·5 mm. The tentacles, of which there are, I think, 15, are withdrawn, and, as far as I can make out, are short and rounded, and possess only one pair of minute processes near the tip.

The purplish skin, which is a good deal wrinkled, and covered with a fine grey mud in the folds, is s en when viewed under a dissecting-lens to be dotted with more or less distant pale spots where the vertical spines of the calcareous "tables" project through the layer of coloured ovoid concretions. On one surface of the body, which is the more convex, these spines project further beyond the surface.

The deposits in the integument are of two kinds—(*a*) orange-brown concentrically-marked ovoid or spherical phosphatic bodies, and (*b*) calcareous "tables" of the usual form. Over the greater part of the body the former constitute the chief feature, being densely massed, the tables being more or less isolated. On the tail, however, matters are reversed: the calcareous perforated plates are larger

* This probably came from Station 83, though both this number and "30" were on labels in the jar; but, as this species has never been obtained off Oamaru (Station 30) in the various dredgings, whereas it, like all its allies, does occur in deep water, and a deeper sounding was at Station 83, I have placed it as above

PLATE XI.



than elsewhere; are close together, often overlapping; are less regular and more varied in form; while the brown bodies are fewer, and grouped to form large irregular compact masses.

The plates on the body have generally 3 or 4 large circular holes, occasionally 2 or 3 additional smaller ones; and from the centre rises a vertical column composed apparently of three rods united by several short transverse bars: it terminates in a trifid point.

These plates measure about 0·2 mm. across; the spines are 0·1 mm. high. On the tail the number and size of the perforations in the plates vary much, but are usually much more numerous than in the body-plates.

Locality.—(?)South of Chasland's (South Island), 43 fathoms, fine sand.*

Remarks.—Two species of "*Trochostoma*" (which Lyman Clark merges into *Molpadia*) have been dredged off the East Cape of New Zealand by the "Challenger"; from each of them our present species differs. *T. violaceum* has spicules of quite a different form—great three-armed plates that are almost solid. From *T. albicans* the presence of coloured ovoids sufficiently distinguishes it. The plates in our species rather recall those of *T. antarcticum* from Kerguelen, which, however, has no coloured bodies in the skin.

I am unable to identify it with any of the species of *Molpadia* enumerated by Dr. Lyman Clark, 1907.

Chirodota gigas Dendy.

Chirodota gigas, Dendy and Hindle, Journ. Linn. Soc. (Zool.), xxx, 1907, p. 110.

Station 12.

Several badly preserved specimens, whose very dark violet integument was nearly wholly macerated away, fragments only being left here and there with the groups of characteristic wheels.

The longest individual measures 230 mm. by 12 mm. This is more than twice the length of the type of the species obtained from Chatham Islands.

Dendy says nothing of the colour of his specimen, and possibly my identification is erroneous.

Locality.—Molyneux Bay, 20–46 fathoms, sand.

[I have others, collected many years ago by Mr. G. M. Thomson off Stewart Island. These measure from 130 mm. to 170 mm. by 39 mm. across the widest part of the body, which is the anterior end. They are, however, very soft, so that the above figures exaggerate the true size.]

* The vial in which this and *Caudina* were enclosed bore the number "7," but I am inclined to think that this species came from deeper water off the coast of the North Island.

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EXPLANATION OF PLATES.

PLATE VII.

Mediaster sladeni Benham.

Fig. 1. Outline of entire animal ($\times \frac{1}{2}$). Only a portion of an arm is filled in.

Fig. 2. Upper surface of a portion of the arm ($\times 2$).

Fig. 3. One of the paxilliform plates ($\times 4$).

Fig. 4. Under-surface of a portion of an arm ($\times 2$), showing the adambulacrals of one side of the groove, and the neighbouring ossicles.

Fig. 5. An oral angle ($\times 4$).

PLATE VIII.

Echinaster farquhari Benham.

Fig. 1. Entire animal (natural size); details shown only in part of the arm.

Fig. 2. A portion of the upper surface of an arm about midway along its length ($\times 2$).

Fig. 3. Under-surface of the distal region of an arm ($\times 2$). A little more than half of the diameter is shown; unfortunately, the relative sizes of the adambulacral spines are not accurately drawn. *b*, *c*, *d*, rows of spines. (*Cf.* fig. 4.)

Fig. 4. Outline of a transverse section of an arm, showing the disposition of the spines on the longitudinal ridges. *a*, *b*, *c*, *d*, the four rows of spines along the arm.

Pentagonaster abnormalis Gray.

Fig. 5. The adambulacral ossicles and neighbouring region ($\times 4$). The spines have been removed from two of the ossicles, the articular cups being shown. A pedicellaria is carried in the slit-like furrow of one of the abactinal plates.

PLATE IX.

Astrotoma waitei Benham.

Fig. 1. Entire animal (natural size), with three arms cut short.

Fig. 2. Portion of the upper surface ($\times 2$).

Fig. 3. Portion of the lower surface (× 2), showing the small madreporite in this interradius.

Fig. 4. Lateral view of a portion of an arm (× 4), showing the groups of hooklets.

Fig. 5. Transverse section of an arm (× 4), showing the arm-spines and their spicules.

Fig. 6. A mouth-angle (× 4), showing the arrangement of the " papillæ."

Plate X.

Amphiura norœ Benham.

Fig. 1. Portion of the upper surface (× 12, camera), showing the essential characters of the species.

Fig. 2. Portion of the under-surface (× 12, camera).

Fig. 3. A side arm-plate, with spines (not to scale).

Luidia sp.

Fig. 4. Portion of a side of an arm, showing the characteristic alternate arrangement of the spines. *d*, the upper, *v*, the lower, surface.

Fig. 5. Two successive marginal plates with spines.

Plate XI.

Molpadia dendyi Benham.

Fig. 1. A group of plates and phosphatic spherules from the middle of the body, only a few of which are indicated, though they fill the spaces between the plates (× 60. camera).

Fig. 2. A calcareous plate from the tail region (× 60, camera).

Fig. 3. Another plate from the tail (not to scale), showing numerous small perforations in addition to three larger holes.

Molpadia marenzelleri Théel.

Fig. 4. Spicules (× 60, camera). A portion of an " anchor " is shown at *d*, and the base of another at *b*. The small circles represent the size of the phosphatic spherules. At *c* is one of the sub-anchor plates with radiating processes. A young plate is also shown.

Echinus angulosus Leske.

Fig. 5. A portion of the test (× 1), showing ambulacral and interambulacral areas. *A* is the ambitus ; below is one plate for each area (× 2)

MOLLUSCA.

PART I.—AMPHINEURA, GASTROPODA, AND SCAPHOPODA.

By Henry Suter.

Plate XII.

The Nudibranchia are omitted. All specimens have been sent to Sir Charles Eliot, K.C.M.G., Sheffield, who has kindly consented to supply a report. Specimens from Stations 26 and 30 were mixed when received, hence the uncertainty expressed.

Class AMPHINEURA.

Family ISCHNOCHITONIDÆ.

Ischnochiton, Gray, 1847.

Ischnochiton longicymba Q. and G.

Chiton longicymba Q. and G., Voy. "Astrolabe," Zool., iii, 1835, p. 390, pl. lxxv, figs. 1–18.

Ischnochiton longicymba Q. and G., Man. Conch. (1), xiv, 1892, p. 87, pl. xxii, figs. 58–66.

Chatham Islands.

Family ACANTHOCHITIDÆ.

Acanthochites, Risso, 1826.

Acanthochites zelandicus Q. and G.

Chiton zelandicus Q. and G., Voy. "Astrolabe," Zool., iii, 1835, p. 400, pl. lxxiii, figs. 5–8.

Acanthochites zelandicus Q. and G., Man. Conch. (1), xv, 1893, p. 16, pl. xiv, figs. 9–10.

Station 12.

Acanthochites porosus Burrow.

Chiton porosus Burrow, Elements of Conchology, 1815, p. 189, pl. xxviii, fig. 1.

Acanthochites (*Cryptoconchus*) *porosus* Burrow, Man. Conch. (1), xv, 1893, p. 36, pl. iii, figs. 57–62.

Stations 22, 74.

Family CHITONIDÆ.

CHITON, Linné, 1758.

Chiton canaliculatus Q. and G.

Chiton canaliculatus Q. and G., Voy. "Astrolabe," Zool., iii, 1835, p. 394, pl. lxxv, figs. 37–42; Man. Conch. (1), xiv, 1892, p. 177, pl. xxxvi, figs. 4–6.

Station 12.

Chiton pellisserpentis Q. and G.

Chiton pellisserpentis Q. and G., Voy. "Astrolabe," Zool., iii, 1835, p. 381, pl. lxxiv, figs. 17–22; Man. Conch. (1), xiv, 1892, p. 173, pl. xxxvii, figs. 14–17.

Chatham Islands.

ONITHOCHITON, Gray, 1847.

Onithochiton semisculptus Pilsbry.

Onithochiton semisculptus Pilsbry, Man. Conch. (1), xiv, 1893, p. 247, pl. lv, figs. 10–11.

Chatham Islands.

Class GASTROPODA.

Family PATELLIDÆ.

HELCIONISCUS, Dall, 1870.

Helcioniscus strigilis Hombr. and Jacq.

Patella strigilis H. and J., Ann. Sci. Nat. (2), xvi, 1841, p. 190; Man. Conch. (1), xiii, 1891, p. 137; Suter, Proc. Mal. Soc., vi, 1905, p. 351.

Chatham Islands.

Family FISSURELLIDÆ.

FISSURIDEA, Swainson, 1840.

Fissuridea monilifera Hutton.

Lucapina monilifera Hutton, Cat. Mar. Moll. N.Z., 1873, p. 42.
Megatebennus moniliferus Hutton, Plioc. Moll. N.Z., 1893, p. 72, pl. viii, fig. 76.

Station 26 or 30.

EMARGINULA, Lamarck, 1801.

Emarginula striatula Q. and G.

Emarginula striatula Q. and G., Voy. "Astrolabe," Zool., iii, 1834, p. 332, pl. lxviii, figs. 21–22; Man. Conch. (1), xii, 1890, p. 259, pl. lxiv, fig. 2.

Station 6.

Family TROCHIDÆ.

Trochus, Linné, 1758.

Trochus tiaratus Q. and G.

Trochus tiaratus Q. and G., Voy. "Astrolabe," Zool., iii, 1834, p. 256, pl. lxiv, figs. 6–11; Man. Conch. (1), xi, 1889, p. 42, pl. xii, figs. 72–74, pl. i fig. 4; Suter, Proc. Mal. Soc., ii, 1897, p. 260.

Station 6.

Monodonta, Lamarck, 1799.

Monodonta æthiops Gmelin.

Turbo æthiops Gmel., Syst. Nat., ed. 13, 1790, p. 3596.

Monodonta æthiops Gmel., Man. Conch. (1), xi, 1889, p. 98, pl. xix figs. 99–100, pl. xx fig. 19.

Chatham Islands.

Monodonta lugubris Gmelin.

Trochus lugubris Gmel., Syst. Nat., ed. 13, 1790, p. 3583.

Monodonta lugubris Gmel., Man. Conch. (1), xi, 1889, p. 100, pl. xix fig. 93, pl. xxxv figs. 24–25.

Chatham Islands.

Cantharidus, Montfort, 1810.

Cantharidus pupillus Hutton.

Cantharidus pupillus Hutton, Proc. Linn. Soc. New South Wales, ix, 1884, p. 362 (not *Trochus pupillus* Gould); Suter, Proc. Mal. Soc., ii, 1897, p. 270, fig. in text.

Dredge Station C.

Gibbula, Risso, 1826.

Gibbula fulminata Hutton.

Chrysostoma fulminata Hutt., Cat. Mar. Moll., 1873, p. 36.

Gibbula fulminata Hutt., Man. Conch. (1), xi, 1889, p. 216, pl. xliii, figs. 14–16.

Chatham Islands.

Monilea, Swainson, 1840.

Monilea semireticulata Suter.

Monilea (*Minolia*) *semireticulata* Sut., Proc. Mal. Soc., viii, 1908, p. 22, pl. ii, fig. 1.

Station 4.

CALLIOSTOMA, Swainson, 1840.

Calliostoma tigris Martyn.

Trochus tigris Martyn, Univ. Conch., ii, 1784, pl. lxxv.

Calliostoma tigris Mart., Man. Conch. (1), xi, 1889, p. 333, pl. xli, fig. 30.

Station 26 or 30.

Family TURBINIDÆ.

LEPTOTHYRA, Dall, 1871.

Leptothyra fluctuata Hutton.

Cyclostrema fluctuata Hutt., N.Z. Journ. Sci., i, 1883, p. 477.

Leptothyra fluctuata Hutt., Man. Conch. (1), xi, 1888, p. 259, pl. lxiv, figs. 47–48; Murdoch, Trans. N.Z. Inst., xxxvii, 1904, p. 222, pl. vii, fig. 10.

Dredge Stations B, C.

ASTRÆA, Bolten, 1798.

Astræa heliotropium Martyn.

Trochus heliotropium, Mart., Univ. Conch., i, 1784 (not 1769), fig. 30.

Astralium heliotropium, Mart., Man. Conch. (1), xi, 1888, p. 228, pl. lvi, fig. 87.

Stations 6, 9, 20, 44.

Family UMBONIIDÆ.

ETHALIA, Adams, 1863.

Ethalia zelandica Hombron and Jacquinot.

Rotella zelandica H. and J., Voy. Pôle Sud., Zool., v, 1854, p. 53, pl. xiv, figs. 5–6.

Ethalia zelandica H. and J., Man. Conch. (1), xi, 1889, p. 459, pl. lviii figs. 9, 32–33, pl. lix fig. 66.

Stations 5, 44.

Family COCCULINIDÆ.

COCCULINA, Dall, 1882.

Cocculina tasmanica Pilsbry.

Acmæa parva var. *tasmanica* Pilsbry, "Nautilus," ix, 1895, p. 128.

Cocculina tasmanica Pils., Murdoch and Suter, Trans. N.Z. Inst., xxxviii, 1905, p. 301.

Cocculina meridionalis Hedley, Mem. Aust. Mus., iv, 1903, p. 331, fig. 64.

Station 4; Dredge Stations B, C.

Family RISSOIDÆ.

RISSOA, Fréminville, 1814.

Rissoa rufoapicata Suter.

Rissoa rufoapicata Sut., Proc. Mal. Soc., viii, 1908, p. 28, pl. ii, fig. 21.

Station 4; Dredge Stations A, B, C.

Rissoa (Cingula) subfusca micronema Suter.

Rissoa (Cingula) subfusca micronema Sut., Proc. Mal. Soc., iii, 1898, p. 4.

Station 4; Dredge Station A.

ANABATHRON, Frauenfeld, 1867.

Anabathron gradatum Suter.

Anabathron gradatum Sut., Proc. Mal. Soc., viii, 1908, p. 32, pl. iii, fig. 33.

Station 4.

Family CERITHIIDÆ.

CERITHIDEA, Swainson, 1840.

Cerithidea tricarinata Hutton.

Cerithidea tricarinata Hutt., N.Z. Journ. Sci., i, 1883, p. 477.

Chatham Islands.

Family CERITHIOPSIDÆ.

CERITHIOPSIS, Forbes and Hanley, 1853.

Cerithiopsis crenistria Suter.

Cerithiopsis crenistria Sut., Trans. N.Z. Inst., xxxix, 1907, p. 256, pl. ix, fig. 4.

Dredge Station C.

Family TRIFORIDÆ.

TRIPHORA, Blainville, 1828.

Triphora lutea Suter.

Triphora lutea Sut., Proc. Mal. Soc., viii, 1908, p. 39, pl. iii, fig. 50.

Dredge Station A.

Family VERMETIDÆ.

SILIQUARIA, Lamarck, 1799.

Siliquaria weldii Tenison-Woods.

Siliquaria weldii T.-Woods, Proc. Roy. Soc. Tasm., 1875 (1876) p. 44.

Siliquaria (*Pyxipoma*) *weldii* T.-Woods, Man. Conch. (1), viii, 1886, p. 191, pl. lviii, fig. 28.

Station 6.

A cluster of dead shells in a sponge.

Family TURRITELLIDÆ.

TURRITELLA, Lamarck, 1799.

Turritella rosea Q. and G.

Turritella rosea Q. and G., Voy. "Astrolabe," Zool., iii, 1834, p. 136, pl. lv, figs. 24–26.

Stations 5, 6, 12, 20, 22, 26 or 30.

Turritella symmetrica Hutton.

Turritella (*Eglisia*) *symmetrica* Hutt., Cat. Mar. Moll., 1873, p. 30.
T. tricincta Hutt., Cat. Tert. Moll., 1873, p. 13 (not of Borson et auct.).
T. kanieriensis Harris, Cat. Tert. Moll. Brit. Mus., pt. i, 1897, p. 241.

Stations 2, 5, 12, 20, 26, or 30; Dredge Stations A, B, C, D.

Family STRUTHIOLARIIDÆ.

STRUTHIOLARIA, Lamarck, 1812.

Struthiolaria papulosa Martyn.

Buccinum papulosum Mart., Univ. Conch., ii, 1784, fig. 54.
Struthiolaria papulosa Mart., Man. Conch. (1), vii, 1885, p. 133, pl. 12, fig. 34.

Station 20.

Family CAPULIDÆ.

CAPULUS, Montfort, 1810.

Capulus calcareus, sp. nov.

Plate XII, figs. 1, 2.

Stations 20, 88; Dredge Station C.

Shell small, fairly solid, somewhat irregularly ovate, very little asymmetrical. Sculpture consisting of fine radiate striæ, crossed by distinct concentric growth-lines; most specimens I have seen had partly lost the epidermis and the radial sculpture, the surface being quite smooth and chalky. Colour yellowish-brown, white after having lost the epidermis, which is thin, horny, and peeling off very easily. Apex projecting far past the base. Protoconch well defined, of $1\frac{1}{4}$ smooth and convex whorls. Whorls $1\frac{3}{4}$, the last half large, convex, expanded towards the aperture; posterior slope below the apex short, concave. Aperture oval to subcircular, expanded, margin uneven, sharp, inside white, polished.

Breadth, 8·5 mm.; length, 11·5 mm.; height, 5 mm.

Dentition.—Formula of radula, 2-1-1-1-2. Central tooth trapezoidal, with a large median and 4 smaller cusps on each side. Lateral

teeth with a large triangular reflection bearing 5 denticles on the inner side. Marginals unciform, the inner teeth with sharply pointed denticles on the posterior edge, outer marginals smooth.

Type in the Canterbury Museum, Christchurch.

Specimens from both trawling stations were fixed to shells of *Syrinx maximus*.

Family CALYPTRÆIDÆ.

CALYPTRÆA, Lamarck, 1799.

Calyptræa maculata Q. and G.

Crepidula maculata Q. and G., Voy. "Astrolabe," Zool., iii, 1835, p. 422, pl. 72, figs. 6–9.

Calyptræa calyptræformis Lamarck, Man. Conch. (1), viii, 1886, 122, pl. 35, fig. 99 (not of Lamarck).

Dredge Station A.

CREPIDULA, Lamarck, 1799.

Crepidula contorta Q. and G.

Crepidula contorta Q. and G., Voy. Astrol., Zool., iii, 1835, p. 418, pl. lxxii, figs. 15, 16.

C. monoxyla Lesson, Man. Conch. (1), viii, 1886, p. 128, pl. xxxvii, figs. 35, 36.

Stations 5, 20.

Family NATICIDÆ.

NATICA, Scopoli, 1777.

Natica zelandica Q. and G.

Natica zelandica Q. and G., Voy. Astrol., Zool., ii, 1832, p. 237, pl. lxvi, figs. 11–12. Man. Conch. (1), viii, 1886, p. 22, pl. iv, fig. 70.

Station 26 or 30.

POLINICES, Montfort, 1810.

Polinices amphialus Watson.

Natica amphiala Wats., "Challenger" Rep., xv, 1886, p. 437, pl. 27, fig. 6.

N. vitrea Hutton, Cat. Mar. Moll., 1873, p. 21.

Station 4; Dredge Stations A, C.

Family SEPTIDÆ.

ARGOBUCCINUM, Herrmansen, 1846.

Argobuccinum argus Gmelin.

Murex argus Gmelin, Syst. Nat., ed. 13, 1790, p. 3547.

Ranella (*Argobuccinum*) *argus* Gmel., Man. Conch. (1), iii, 1881, p. 44, pl. xxiv, figs. 61–65.

Stations 20, 26 or 30.

Family TONNIDÆ

TONNA, Brünnich, 1772.

Tonna variegata Lamarck.

Dolium variegatum Lam., Anim. s. Vert., vii, 1822, p. 261; Man. Conch. (1), vii, 1885, p. 262, pl. iii, figs. 13, 14.

Stations 20, 88.

Family EPITONIIDÆ.

EPITONIUM, Bolten, 1798.

Epitonium zelebori Dunker.

Scalaria zelebori Dkr., Verh. Zool. Bot. Gesell. Wien, xvi, 1866, p. 912; Man. Conch. (1), ix, 1887, p. 78, pl. xv, fig. 75.

Dredge Stations C, D.

Family PYRAMIDELLIDÆ.

ODOSTOMIA, Fleming, 1828.

Odostomia inornata Suter.

Odostomia inornata Sut., Trans. N.Z. Inst., xl, 1908, p. 364, pl. 28, fig. 8.

Dredge Station B.

The specimen is large, having 7 whorls. Diam., 2·5 mm.; height, 6·8 mm.

Family TURBINELLIDÆ.

SYRINX, Bolten, 1798.

Syrinx maximus Tryon.

Siphonalia maxima Tryon, Man. Conch. (1), iii, 1881, p. 135, pl. liv, fig. 355. Hedley, Mem. Aust. Mus., iv, 1903, p. 374, pl. xxxviii.

Stations 20, 88, 89.

Family MITRIDÆ.

VEXILLUM, Bolten, 1798.

Vexillum biconicum Murdoch and Suter.

Vulpecula (*Pusia*) *biconica* M. and S., Trans. N.Z. Inst., xxxviii, 1905 (1906), p. 289, pl. xxxiii, fig. 22.

Station 4.

Vexillum waitei, sp. nov.

Plate XII, fig. 3.

Station 4; Dredge Stations A, B.

Shell small, fusiform, turreted, with strong axial ribs rendered slightly nodulous, spiral liræ; with only 3 columellar folds. Sculpture

consisting of strong and sharp spiral threads, 4 on the penultimate whorl, the interstices somewhat broader than the threads, a small and flat thread below the suture; they are crossed by distant, broadly rounded axial ribs, 10 to 11 on a whorl, and they are cut up into broad nodules by the spirals, they vanish on approaching the base; growth-lines very fine and crowded. Colour white. Spire elevated conic, turreted, about the same height as the aperture; outlines slightly convex. Protoconch small, of $1\frac{1}{2}$ smooth turns. Whorls 5 to 6, distinctly shouldered, lightly rounded below the keel; base somewhat contracted. Suture not much impressed, margined. Aperture high and narrow, angled above, with an open, short, and slightly recurved canal below, its base not notched. Outer lip convex, indistinctly angled above, and somewhat contracted below. Columella slightly oblique, with 3 plaits, the lowest a little smaller; inner lip thin and narrow, forming a very thin layer on the concave parietal wall, drawn out to a long and fine point along the inner edge of the canal.

Diam., 2·7 mm.; height, 6·5 mm.

Type in the Canterbury Museum, Christchurch.

The type specimens were taken at Station 4.

Named in honour of Mr. Edgar R. Waite, F.L.S., Curator of the Canterbury Museum, the discoverer of the species.

Family BUCCINIDÆ.

COMINELLA, Gray, 1857.

Cominella maculata Martyn.

Buccinum maculatum Mart., Univ. Conch., ii, 1784, fig. 49.

Cominella maculata Mart., Man. Conch. (1), iii, 1881, p. 204, pl. lxxxi, figs. 421–424.

Chatham Islands.

Cominella maculosa Martyn.

Buccinum maculosum Mart., Univ. Conch., i, 1784, fig. 8.

Cominella testudinea Chemn., Man. Conch. (1), iii, 1881, p. 203, pl. lxxx, figs. 414, 415.

Chatham Islands.

Cominella nassoides Reeve.

Buccinum nassoides Rve., Conch. Icon., Buccinum, 1846, sp. 12.

Cominella nassoides Rve., Man. Conch. (1), iii, 1881, p. 206, pl. lxxxi, figs. 442, 443.

Station 26 or 30.

Family MURICIDÆ.

MUREX, Linné, 1758.

Murex zelandicus Q. and G.

Murex zelandicus, Q. and G., Voy. Astrol., Zool., ii, 1833, p. 529, pl. xxxvi, figs. 5–7; Man. Conch. (1), ii, 1880, p. 108, pl. xxix, fig. 268.

Station 89.

TROPHON, Montfort, 1810.

Trophon ambiguus Philippi.

Fusus ambiguus Phil., Abbild. and Beschr. neuer Conch., Fusus, 1844, pl. i, fig. 2.

Trophon ambiguus Phil., Man. Conch. (1), ii, 1880, pl. xxxiii, fig. 365.

Stations 4, 5, 6, 29, 44; Dredge Station C.

Trophon aucklandicus E. A. Smith.

Euthria aucklandica E. A. Smith, Voy. "Southern Cross," Moll., 1902, p. 203, pl. xxiv, figs. 12, 13.

Station 5.

Trophon bonneti Cossman.

Trophon (*Trophonopsis*) *bonneti* Cossm., Essais de Paléoconch. Comp., v, 1903, p. 200, pl. iii, fig. 7.

T. ambiguus pumilus Suter, Journ. of Mal., vii, 1899, p. 55.

Station 20.

Trophon convexus, sp. nov.

Plate XII, fig. 4.

Dredge Station B.

Shell very small, fusiform, thin, axially costate and spirally lirate. Sculpture consisting of strong, broadly rounded axial costæ, about 10 on a whorl, extending from suture to suture, but absent on the base, crossed by distant and prominent spiral cords, with a few intercalated fine threads upon the neck of the canal, produced into oval nodules upon the axial ribs; the spire-whorls with a fine thread below the suture, margining it, and 3 distant strong spirals below it; body-whorl with 14–15 cinguli, those upon the base not nodulous. Fasciole hardly discernible. Colour yellowish-brown, neck of canal and inner lip whitish, interior of aperture light brown. Spire acuminate, conic, of the same height as the aperture with canal. Protoconch papillate, of $1\frac{1}{2}$ smooth and convex whorls, the globular nucleus slightly lateral. Whorls 5, regularly increasing, convex; base contracted towards the canal. Suture but little impressed, undulating, margined below.

Aperture subvertical, ovate, angled above, produced below into a moderately long, oblique and slightly recurved, widely open canal. Outer lip thin and sharp, convex, crenulated by the spiral sculpture, smooth inside. Columella vertical, straight, twisted and narrowed below; inner lip thin and narrow, extending over the excavated parietal wall, drawn out to a narrow ridge towards the inner margin of the canal. Operculum unknown.

Diam., 3·5 mm.; height, 7 mm.

Type in the Canterbury Museum, Christchurch.

Remarks.—This species is nearly allied to *T. curtus* Murdoch, but it is larger, has the whorls not shouldered, no colour-bands, and the strong spiral on the neck of the canal is also wanting; the protoconch has convex, not carinated whorls.

Trophon corticatus Hutton.

Fusus corticatus Hutt., Cat. Mar. Moll. 1873, p. 9.

Trophon duodecimus Gray, Hutton, Plioc. Moll. N.Z., 1893, p. 39, pl. vi, fig. 7 (not of Gray).

Station 26 or 30.

Trophon crispulatus Suter.

Trophon (*Trophonopsis*) *crispulatus* Sut., Proc. Mal. Soc., viii, 1908, p. 178, pl. vii, fig. 2.

Station 4; Dredge Station A.

Trophon plebeius Hutton.

Fusus plebeius Hutt., Cat. Mar. Moll., 1873, p. 9.

Trophon plebeius Hutt., Plioc. Moll. N.Z., 1893, p. 39, pl. vi, fig. 6.

Station 20.

Family THAISIDÆ.

THAIS, Bolten, 1798.

Thais scobina albomarginata Deshayes.

Purpura albomarginata Desh., Rev. Zool. Soc. Cuv., 1839, p. 360.

P. scobina albomarginata Desh., Man. Conch. (1), ii, 1880, p. 170, pl. 51, figs. 121–124.

Chatham Islands.

Family CANCELLARIIDÆ.

ADMETE, Kröyer, 1842.

Admete trailli Hutton.

Cancellaria trailli Hutt., Cat. Mar. Moll., 1873, p. 26; Plioc. Moll. N.Z., 1893, p. 58, pl. vii, fig. 52.

Dredge Station C.

Family PYRENIDÆ.

ALCIRA, H. Adams, 1860.

Alcira sulcata Hutton.

Lachesis sulcata Hutton, Cat. Mar. Moll., 1873, p. 12.

Columbella huttoni Sut., Index Faunæ N.Z., 1904, p. 72, for *C. sulcata*, Hutt., preoccupied; Murdoch, Trans. N.Z. Inst., xxxvii, 1904, p. 223, pl. vii, fig. 12.

Station 4; Dredge Station C.

Family VOLUTIDÆ.

FULGURARIA, Schumacher, 1817.

Fulguraria arabica elongata Swainson.

Voluta elongata Swains., Exot. Conch., 1821, pl. xx, xxi.

Voluta pacifica elongata Hutton, Man. N.Z. Moll., 1880, p. 62.

Stations 3, 5, 20.

Family OLIVIDÆ.

ANCILLA, Lamarck, 1801.

Ancilla mucronata Sowerby.

Ancillaria mucronata Sow., Spec. Conchyl., 1830, p. 8, figs. 47, 48; Reeve, Conch. Icon., Ancillaria, 1864, pl. iv, fig. 10.

Station 89; Dredge Station D.

Family MARGINELLIDÆ.

MARGINELLA, Lamarck, 1799.

Marginella albescens Hutton.

Marginella albescens Hutt., Cat. Mar. Moll. 1873, p. 19. Man. N.Z. Moll., p. 62.

Station 4; Dredge Station B.

CRYPTOSPIRA, Hinds, 1844.

Cryptospira (Closia) profunda, sp. nov.

Plate XII, fig. 5.

Dredge Station B.

Shell small, ovoid, smooth and polished, white, with four columellar plaits. The only sculpture consists of very faint, rounded growth-periods. Colour white. Spire involute, flat, covered by enamel. The last whorl occupies the whole height of the shell; it is lightly convex, narrowed below, with a light basal limb. Aperture high and narrow, arched, narrowly rounded above, slightly emarginate below. Outer lip convex, thickened, with a light varix, extending above beyond the spire and concealing it, inside lightly crenate. Columella oblique, straight, with 4 almost transverse plaits, the lower two stronger than the others.

Diam., 3·8 mm.; height, 5·8 mm.

Type in the Canterbury Museum, Christchurch.

Family TURRITIDÆ.

Mitromorpha, A. Adams, 1865.

Mitromorpha gemmata Suter.

Mitromorpha gemmata Sut., Proc. Mal. Soc., viii, 1908, p. 186, pl. vii, fig. 18.

Dredge Stations A, B.

Mangilia, Risso, 1826.

Mangilia munda, sp. nov.

Plate XII, fig. 6.

Dredge Station D.

Shell small, elongate fusiform, thin and fragile, white, turreted, axially costate and spirally striated. Sculpture consisting of narrowly rounded, slightly oblique axial riblets, about 16 on the last whorl, nearly continuous over the whorls, obsolete on the base, the interstices slightly broader than the riblets; they are crossed by spiral threads, 4 fine and close together on the shoulder, 1 on the carina of the whorl and 3 below it, the uppermost of these at some distance from the keel; the crossing-points produced into small oval gemmules; the base is spirally striate, all the striæ in front of the aperture being smooth. Colour white. Spire elevated conic, turriculate, nearly $1\frac{1}{2}$ times the height of the aperture. Protoconch globular, of $1\frac{1}{2}$ smooth whorls, the nucleus broadly rounded. Whorls 6, regularly increasing, with a high sloping shoulder, the keel on the spire-whorls near the middle, flat above and below the keel; base contracted. Suture somewhat impressed, lightly margined below. Aperture pyriform, broadly angled above, with a short, broad, oblique, and truncated canal below. Outer lip convex, thickened by an axial rib, slightly angled above and somewhat contracted below, with a shallow broad sinus at the suture. Columella slightly oblique, lightly excavated towards the straight parietal wall, curved below, and extending to the left margin of the canal; inner lip thin, narrow, smooth.

Diam., 3·2 mm.; height, 7·5 mm.

Type in the Canterbury Museum, Christchurch.

Remarks.—The species is closely related to *M. dictyota*, Hutt., which, however, has less axial riblets, the angle of the shoulder is above the middle of the spire-whorls, and the protoconch is much smaller, with a minutely pointed nucleus.

Daphnella, Hinds, 1845.

Daphnella crassilirata Suter.

Daphnella crassilirata Sut., Proc. Mal. Soc., viii, 1908, p. 190, pl. vii, fig. 27.

Station 4.

Family SCAPHANDRIDÆ.

CYLICHNELLA, Gabb, 1873.

Cylichnella striata Hutton.

Cylichna striata Hutt., Cat. Mar. Moll., 1873, p. 52; Murdoch, Trans. N.Z. Inst., xxxvii, 1904, p. 218, pl. vii, figs. 1, 2.

Station 4.

Family ONCHIDIDÆ.

ONCHIDELLA, Gray, 1850.

Onchidella nigricans Q. and G.

Onchidium nigricans Q. and G., Voy. Astrol., Zool., ii, 1832, p. 214, pl. xv, figs. 24–26.

Onchidella nigricans Q. and G., Hutton, Man. N.Z. Moll., 1880, p. 28.

Chatham Islands.

Class SCAPHOPODA.

Family DENTALIIDÆ.

DENTALIUM, Linné, 1758.

Dentalium nanum Hutton.

Dentalium nanum Hutt., Cat. Tert. Moll., 1873, p. 1; Plioc. Moll. N.Z., 1893, p. 73, pl. viii, fig. 78.

Stations 2, 79; Dredge Station D.

Dentalium huttoni T. W. Kirk.

Dentalium huttoni T. W. Kirk, Trans. N.Z. Inst., xii, 1880, p. 306.

Station C.

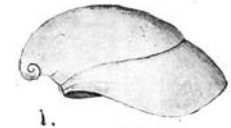
Dentalium zelandicum Sowerby.

Dentalium zelandicum Sow., Thes. Conch. iii, 1860, p. 101, pl. ccxxiii, fig. 13; Man. Conch. (1), xvii, 1904, p. 70, pl. vi, fig. 81.

Station 2.

EXPLANATION OF PLATE XII.

Figs. 1, 2. *Capulus calcareus* Suter, 8·5 mm. by 11·5 mm. by 5 mm.
Fig. 3. *Vexillum waitei* Suter, 2·7 mm. by 6·5 mm.
Fig. 4. *Trophon convexus* Suter, 3·5 mm. by 7 mm.
Fig. 5. *Cryptospira profunda* Suter, 3·8 mm. by 5·8 mm.
Fig. 6. *Mangilia munda* Suter, 3·2 mm. by 7·5 mm.



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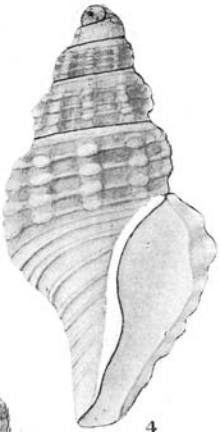

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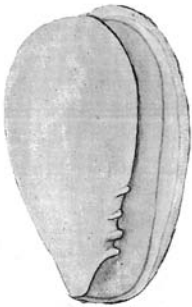

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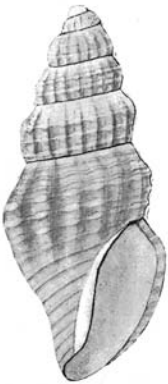

6.

[*H. Suter, del.*

PISCES.

By Edgar R. Waite, F.L.S.

PART I.

Plates XIII–XXIII.*

The present instalment deals only with the Cyclostomata, Selachii, and Holocephali, the following species having been taken :—

Cyclostomata.

Eptatretus cirrhatus Forster.

Selachii.

Cephaloscyllium laticeps Duméril.
Galeus australis Macleay.
Mustelus antarcticus Günther.
Squalus fernandinus Molina.
Narcacion fairchildi Hutton.
Typhlonarke aysoni Hamilton.
Raja nasuta Müller and Henle.
Arhynchobatis asperrimus Waite.
Dasybatus brevicaudatus Hutton.
Myliobatis tenuicaudatus Hector.

Holocephali.

Callorhynchus callorynchus Linnæus.

Typhlonarke is a new generic name proposed for *Astrape aysoni* Hamilton. The genus differs from *Narke* (*Astrape*), in addition to other peculiarities, by its only representative being blind. *Arhynchobatis asperrimus* is the type of a new genus and species of the Rajidæ allied to *Psammobatis*.

In addition to a detailed description, some interesting habits of *Eptatretus cirrhatus* are supplied, illustrated by photographs of the lingual teeth and their effect on the body of another individual of the same species.

The egg-cases of *Cephaloscyllium laticeps* and *Raja nasuta* are figured, those of the former species being for the first time made known.

* For explanation of plates see p. 155.

An examination of the numb-fishes (*Narcacion*) results in the removal of a nominal species from the list, one only being now admitted.

The species are illustrated by reproductions from photographs kindly taken for me by Mr. Rudolf Hülsen, and Mr. W. J. Sparkes, taxidermist of the Museum.

Hitherto the illustrations of many of the species, where such have been figured, are in outline only, while the original descriptions are not generally accessible in New Zealand.

CLYCLOSTOMATA.

Eptatretus, Duméril, 1819.

Eptatretus cirrhatus Forster.

Blind-eel.

Plate XIII.

Petromyzon cirrhatus Forster, in Bloch and Schneider, Syst. Ichth., 1801, p. 532.

Bdellostoma cirrhatum Günth., Cat. Fish. Brit. Mus., viii, 1870, p. 511.

Heptatrema cirrata Hutton, Index Faunæ N.Z., 1904, p. 55.

Station 35.

The gill-openings appear to be normally seven in number, but I have seen an example in which there were but six openings on one side, though seven were present on the other. They are situated at a great distance from the head, the first opening being one-fourth the length of the entire animal from the snout. The last aperture is frequently much larger than the others. They lie rather low down on the body, the posterior ones being deflected still lower, so that the whole series forms a curve.

The eyes are situated towards the upper part of the head, though a long way apart, and removed from the tip of the snout about one-third its distance to the first gill-opening. The position of the eyes is indicated by a clear area in the skin, though the eyes themselves cannot be seen. On removing the skin, however, they are very apparent, imbedded in the muscles of the head; they are elliptical in shape, and are placed obliquely, the axes being from above backwards and downwards, and more vertical than horizontal; in adult specimens the diameter of the pupil is 2·5 mm.

It is probable that sight is very imperfect, and, in common with many blind or partially blind animals, tactile adjuncts in the form of feelers or barbels are well developed. The single nostril is a wide tube opening forward, quite in front of the head, and forming its upper anterior border: two barbels are situated on each side of the nostril. The mouth is very large, but closes to a longitudinal slit

with many plications or wrinkles. It has two pairs of barbels towards its front portion, a long widely spaced pair before, and a shorter blunt pair nearer the margin of the mouth and further back.

To a fisherman the chief peculiarity of the blind-eel is its faculty of secreting an apparently unlimited quantity of thick slime. This product is exuded from two rows of glands running one on each side of the animal. The external apertures are below the middle of the body in the same line as the anterior gill-openings, and, where these latter occur, the mucous pores are situated each close below a breathing-opening but somewhat posterior to it. As the posterior gill-openings are deflected downwards, as before described, the hinder slime-pores are also thrown out of line, but the original line is resumed by the pore following the last gill-opening: it is therefore placed considerably higher than the one immediately preceding it. The mucous or slime pores commence on the head, and are continued at regular intervals to nearly the end of the tail, a short break occurring over the vent, corresponding to the omission of two pores: here also the regular line is broken, the post-ventral pores occupying a higher position. There are about seventy-five pores on the body, of which fourteen to sixteen are anterior to the gill-openings and thirteen on the tail. The position of the mucous-pores corresponds to the myotomes or muscle-bands.

There is a low fold of skin on the lower surface of the body arising posterior to its middle length, and continued to the vent: there is no fold on the upper surface. The vent lies at the base of the tail, its distance from the extremity being little more than half that of the first gill-opening from the tip of the snout: this latter distance is one-fourth of the entire length or three times the space between the first and last gill-openings.

Anteriorly the body is circular in section, but towards the middle becomes compressed and deeper, its depth being about one-tenth its length; the compression increases towards the tail, which has an eel-like form: it does not taper, however, its extremity being subtruncate.

The teeth are very peculiar, but well adapted to their function: there is a single tooth in the mid-line above, directed backwards, but capable of being erected; it is rather long and spine-like. The lower series of teeth, situated on the tongue, are much more complicated: they comprise two pairs of longitudinal flexible plates, set combwise, the anterior ones being confluent at the base. The teeth are directed inwards and backwards, and there are twelve in each of the series in the specimen examined—that is, forty-eight in all. All the teeth, including the single upper one, are deep-yellow in colour.

When in repose the teeth lie a long way down the throat, and it would seem impossible for the creature to seize its prey. When,

however, a fish is attacked, the whole of the lower series of teeth is everted, thrown forward out of the mouth, and each set of two rows widely separated on the mid-line; they then present an apparatus much like a grappling-devil used in dredging, and are illustrated on Plate XIII, fig. 2.

Describing the American *Polistotrema stouti*, Jordan and Evermann write:* "The hagfish fastens itself usually on the gills or isthmus (throat) of large fishes, sometimes on the eyes, whence it works its way very rapidly into the inside of the body. It then devours all the flesh of the body without breaking the skin, so that the fish is left a living hulk of head, skin, and bones. It is especially destructive to fishes taken in gill-nets. In every gill-net in summer, at Monterey, more or less of these empty shells of fishes are obtained. When these are taken from the water the hagfish scrambles out with great alacrity. It is thought that the hags enter the fishes after they are caught. A fish of 10 lb. to 15 lb. weight will be devoured by them in a single night. Large fishes of even 30 lb. weight are often brought up without flesh and without viscera, and they certainly do not swim into a gill-net in this condition."

When trawling in the neighbourhood of Otago Heads, and particularly in Blueskin Bay (which, from the many diseased fishes obtained there, is dubbed "the Hospital" by local fishermen), quite a number of fishes were obtained, chiefly terakihi (*Cheilodactylus macropterus*) and red-cod (*Physiculus bachus*), with large wounds in their sides: these wounds, I am convinced, were the work of blind-eels; and, as the fishes were still alive, there can be no doubt that these parasites were feeding when enclosed by the net, or attacked the fishes already enclosed, and, being disturbed when hauling the trawl, left their victims and escaped through the meshes. In no instance did I observe that the gills had been attacked, though it is quite possible that ingress may be also obtained in that way. What seems worthy of emphasis is the circumstance that the blind-eel can actually hold on to the side of a fish, rasp off the scales, and bore into the flesh. Whether this is possible only when the victim is netted, or whether a free fish can be so attacked, we have not sufficient evidence to show. It is well known that fishes caught in a meshing or gill net are particularly liable to attack: one such instance was afforded at the Chatham Islands. A meshing-net set for moki (*Latris ciliaris*) on being raised was seen to have a large tangled knot in it. On clearing the knot it was found to contain a terakihi and a blind-eel, both dead; the former with a large wound in its side, the latter almost inextricably threaded through the meshes, and in one place almost cut in two by the twine. The one surpassing circumstance was the fact that the blind-eel was meshed at all, considering its eel-like shape and slimy coat.

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* Jordan and Evermann, Bull. U.S. Nat. Mus., 47, i, 1896, p. 6.

The blind-eel is well known to the line fishermen, and when one is hooked it at once rolls itself round and round, and tangles the line most hopelessly. The only procedure is to cut the line and drop the creature back into the sea. Expressions of disgust when one is hooked are universal. As an instance I am tempted to relate the following episode. The only time blind-eels were taken in the trawl occurred off Timaru, when three examples were hauled aboard from a depth of 21–29 fathoms. They were covered with the characteristic slime, which adhered to everything, and it was with difficulty that I prevented the men from shovelling them overboard. I placed the three into a bucket, and had considerable trouble in keeping them there. First one and then another would glide out, sometimes head sometimes tail first, and I could not induce any one else to touch them. I next introduced formalin and water, and in a very short time the whole became a thick, viscid, sickening mass. The creatures, being irritated by the formalin acting on the skin or entering their gill-openings, made savage attacks on each other, drawing blood freely, which coloured the slimy mass as they writhed through it. It was on such occasions that I was able to witness the eversion of the lingual teeth, and to ascertain exactly how the creatures seized and ate their prey. All the animals had received scars, and one of them shows that it had been bitten no less than fifteen times by the other two. Not only did they attack each other in the slime-mass, but they would raise their heads above the surface, open their mouths, and protrude their teeth-studded tongues; the two lateral halves would then be widely separated and gnashed together again, possibly in agony. By the time the creatures were dead it was nearly dark, and I placed the bucket with its thick slimy contents in a position usually occupied by another bucket, wherein I kept clean water for the purpose of rinsing my hands after immersion in formalin. It appears that, in the dim light, the captain, thinking to similarly rinse his hands, plunged them among the blind-eels. The disgusting and loathsome sensation proved too much for the peace of his stomach, and a visit to the vessel's side was the immediate result. By the following morning the slime had lost all its viscosity, and I lifted out the blind-eels in a very clean state. I then discovered a number of parasitic leeches attached to them: these have been provisionally determined, by Professor Benham, as species of *Trachelobdella* Diesing (*Calliobdella* Van Beneden).

The average length of an adult specimen is 680 mm. (27 in.), and the colour varies from blue to bluish violet. Some examples show irregular white spots and markings; the ventral fold and the margin of the tail may also be white.

Taken at Station 35, off Timaru, at a depth of 21–29 fathoms; also in a meshing-net at the Chatham Islands, where the Maori name is " tuere."

Since writing the foregoing I have referred to Dr. Bashford Dean's magnificent work "On the Embryology of *Bdellostoma stouti*,* with a copy of which I have been kindly favoured by the author. Of the American hagfishes Dr. Dean says that when placed in pails they exhibit constant movements, writhing from top to bottom, sometimes lifting their nostrils out of water, but he has never seen the tongue everted naturally. I am fortunate, therefore, in having repeatedly witnessed this action on the part of the New Zealand blind-eel. In order to show more clearly the precise nature of the scar left by the teeth, I furnish a photograph of one natural size (pl. xiii, fig. 3), from the creature figured in full, on the skin of which several such scars will be noticed.

SELACHII.

Family SCYLIORHINIDÆ.

CEPHALOSCYLLIUM, Gill, 1861.

Cephaloscyllium laticeps Duméril.

CARPET-SHARK.

Plate XIV, fig. 1, and XXI, fig. 1.

Scyllium laticeps Duméril, Rev. et Mag. Zool. 1853, p. 84, pl. iii, fig. 2.
Cephaloscyllium laticeps Gill, Ann. Lyc. Nat. Hist. New York, vii, 1861, p. 412; Hutton, Index Faunæ N.Z., 1904, p. 54.

Stations 22, 23, 26, 27, 28, 30 (egg), 36, 37, 89, 90, 93, 94, 95, 96.

Head extremely broad and depressed, its breadth equal to its length, which is 5·6 in the total. Interocular breadth half the width of the head, eyes on upper surface but directed laterally. Spiracle rather large, behind and below the eye. The gill-slits regularly decrease in size; the two last are situated over the base of the pectoral. Snout short, rounded, its margins sinuous. Mouth very large, without distinct labial fold. Teeth similar in both jaws, small, with broad base and three cusps, the lateral ones small; about six series of teeth in use, seventy rows in the upper and sixty in the lower jaw. Nostrils close to the margin of the snout, and widely separated; in addition to the usual anterior valve, the posterior margin is also provided with a lobe of skin.

The first dorsal fin arises a little behind the middle of the length and above the middle of the ventrals. The anterior and posterior insertion of the second dorsal is behind the corresponding situation of the anal respectively. The second dorsal is smaller than either the first dorsal or the anal.

* Dean, Festschrift C. V. Kupffer, 1899, p. 224.

The skin is very rough, especially on the back, where the prickles are large. Scales on the upper surface of the tail not enlarged. A row of isolated large scales arises on each side in the occipital region, and is traceable as far as the second dorsal, where it merges into a low ridge continued along the caudal. These two rows of enlarged scales are most pronounced, as usual in the Scyliorhinidæ, &c., in young examples.

The colour is brown above and white below, the upper part with black transverse blotches disposed alternately wider and narrower; the wide bands occur on the occiput, between it and the first dorsal, below both dorsals, one at the base and another towards the middle of the caudal lobe. There is also a black mark below the eye, another below the occipital patch and connected with the first narrow band, and others along the sides of the body. In the young, patches occur also on the ventrals, anal and lower caudal lobe, but all the markings become confused in the adult and tend to break up into spots. One remarkable example is varied with cream-coloured markings most irregularly disposed.

Length, 1,010 mm.

A young example which escaped from the egg as soon as it was placed in formalin measures 162 mm., and was evidently just on the point of emergence: the yolk-sac is all but absorbed, but the caudal membrane has not completely surrounded the termination of the notochord. In young examples the caudal is relatively shorter than in the adult, the origin of the first dorsal then lies in the anterior half of the body; in such also three gill-slits are above the pectoral fin.

When taken from the net the carpet-sharks were of relatively enormous girth, due to the inflation of the stomach with water. When the abdomen was pierced with a penknife-blade a jet of water spurted out to a distance of several feet, due to the elasticity of the stomach.

This inflation is common to members of the genus, and American and Japanese species are described as inflating their stomachs with air, when they float belly upwards. This recalls the toados or puffers (Tetraodontidæ), which possess a precisely similar habit when disturbed. The boys around Port Jackson take advantage of this peculiarity, and roll examples of *Tetraodon hamiltoni* and *T. hypselogenion* between their hands until they attain ludicrous dimensions.

It is more than probable that the carpet-sharks taken in the trawl, being unable to reach the surface and so imbibe air, filled their stomachs with water instead, and it is to be expected that other species would act in the same way under similar conditions.

The carpet-shark was trawled on fourteen occasions, at depths ranging from 13 to 94 fathoms, and from Molyneux Bay in the south to Whale Island in the Bay of Plenty. The "Doto" obtained *Scyllium laticeps* off Bream Bay, S. lat. 36°. At Stations 27 and 28

fully formed eggs enclosed within their cases, ready for extrusion, were taken from the bodies of females. I was thus able to identify egg-cases taken *in situ* among the weed at Station 30 in 35 fathoms. Apart from this, however, the young shark previously mentioned escaped from the egg the moment it was immersed in the preservative, and swam about most actively for a long time.

The egg-case, which has not before been described, is long and narrow in shape, strongly compressed above, where its margin is straight and very wide, about 1·3 in the greatest width, which occurs near the second third of the length; the lower end is much more contracted, the angles bent inwards. Each of the four angles is furnished with long tendrils which are twisted among seaweed, &c. The lateral edges of the egg-case are conspicuously flattened, the thickness of the edge being about 3 mm. When viewed in the hand the efferent slits are on the left side, one in the upper and the other in the lower third. On turning the egg-case round, a similar aspect is, of course, presented.

The cases—in all instances two in number—taken from the oviducts of the female were of very pale creamy-white colour, with yellow tendrils; these latter are formed quite straight in the shell-gland, but become twisted by being forced into a narrow space as produced. The deposited eggs are of darker hue, but are much lighter in colour than those I have seen of other members of the family, or of the Rajidæ. The egg-case is illustrated on Plate XXI, fig 1.

The egg-cases vary in size: four measured yield the following dimensions :—

——	(*a.*)	(*b.*)	(*c.*)	(*d.*)
	mm.	mm.	mm.	mm.
Length of body (median)	127	123	114	102
Width of body	45	45	43	44
Thickness of body	28	25	29	26
Width of upper (exit) end	32	31	33	33

Three species of *Cephaloscyllium* are known, namely :—

C. laticeps Duméril, 1853 (the type); Australia, Tasmania, and New Zealand.

C. ventriosum Garman, 1880; American Pacific Coast, California to Chili.

C. umbratile Jordan and Fowler, 1903; Japan.

Mr. C. Tate Regan* regards *C. uter* Jordan and Gilbert as a synonym of *C. ventriosum*, and places all species in the genus *Scyliorhinus*.

* Regan, Ann. Mag. Nat. Hist. (8), i, 1908, p. 458.

Family CARCHARIIDÆ.

GALEUS, Rafinesque, 1810.

Galeus australis Macleay.

TOPE.

Plate XV.

Galeus australis Macleay, Proc. Linn. Soc. N.S.W., vi, 1881, p. 354.
Galeorhinus australis Hutton, Index Faunæ N.Z., 1904, p. 54.

Stations 3, 14, 63, 72, 80, 88, 91, 95.

Length of head 5·3, of tail 4·3, in the total length; width of head, 1·55; interorbital space, 2·3, equals length of snout and width of mouth; pectoral fin, 1·4 in the length of the head; eye, 2·7 in the interorbital space.

Head much depressed. Snout, viewed from above, acute with the tip rounded, pointed in profile; eye elongate, lateral, nictitating membrane wholly covers the eye when lifted; the mouth forms nearly a half-circle, rami of mandible slightly flattened. A large labial fold on the upper and a smaller one on the lower jaw, teeth alike in both jaws, very oblique, the front edge straight and smooth, the hinder one notched, with strong serrations on the lower limb. Nostrils close to but just below the lateral margin, nearer the mouth than tip of snout. Spiracle a small horizontal fissure on a level with the middle of the eye, but half a diameter behind it. Gill-openings subequal in size, the fourth in line with the anterior edge of the pectoral.

Body elongate, slightly compressed in front, rounded on caudal portion. Shagreen very fine.

First dorsal large, a little nearer the end of the snout than the second dorsal, which is small, its origin and termination being in advance of respective positions of anal. Anal slightly smaller than the second dorsal, its origin nearer to the caudal than to the posterior insertion of the ventrals. Pectorals large, reaching to beneath middle of first dorsal base, origin of ventrals nearer to second than to origin of first dorsal. Caudal but little bent upwards; the base of the lower lobe very little longer than the terminal portion. Peduncle without pits, deeper than broad, its length above 2·4 in that of the caudal.

Colour, bluish grey above and white beneath.

Length of specimen described, 940 mm. The largest taken measured 1,670 mm. (= 5½ ft.).

This shark was taken on eight occasions, at depths ranging from 13 to 105 fathoms, and up to the extreme limits of the course. One example was caught in a set-net at the Chatham Islands. All the adult females were found to contain well-developed young in large numbers, each in a separate thin membranous envelope within the uteri. One example contained thirty-four young, seventeen in each uterus. They measure 230 mm. in length, and differ from the adults

in having the spiracle larger and almost circular, by the shagreen being not developed to the hinder margin of any of the fins. The dorsals and pectorals are dark grey, the posterior aspects excepted; there is also an unclouded triangular space in the lower half of the first dorsal. The tip of the caudal and the concavity of its lower lobe are nearly black. (Plate XV).

The stomachs of the adults contained an assortment of fishes of different species, chiefly those taken in the trawl at the same station, including *Promethichthys prometheus* and much-digested pleuronectids.

The foregoing description is drawn up from an immature specimen, the adult which I had prepared and preserved having unfortunately been washed overboard during a storm, together with many other specimens, and some collecting-gear.

There can be little doubt that the New Zealand *Galeus* has been correctly referred to *G. australis*, though what are the distinguishing characters of that species is not clear. Macleay wrote, "This fish has generally been regarded as identical with *Galeus canis*, the 'tope' of English fishermen. I think I am justified in separating them."

In the report for 1900, the "tiger-shark (*Lamna glauca*)" is recorded as having been taken in the trawl on fifteen occasions, and in the 1901 report it is stated to have been thrice obtained. This is a very palpable error of identification, or, rather, naming; and it is almost certain that the shark trawled was *Galeus australis*, more especially as this species, not recorded, was taken so often during our cruise. In the latter report, unspecified "sharks" were netted at eight stations. I have no means of knowing what species may have been taken, but it is probable that all were examples of *Galeus australis*.

The trivial names of this and other species have been adopted by early writers from British representatives, but these names are not necessarily in use. As, however, the differences between, say, *Galeus* and *Mustelus* are scarcely appreciated by the colonists, the book-names applied are here retained.

MUSTELUS, Linck, 1790.

Mustelus antarcticus Günther.

SMOOTH-HOUND.

Plate XIV, fig. 2.

Mustelus antarcticus Günther, Cat. Fish. Brit. Mus., viii, 1870, p. 387.

Galeus antarcticus Waite, Rec. Aust. Mus., iv, 1902, p. 175, fig. 19.

Stations 2, 7–9, 12–24, 28, 29, 31, 34, 36, 37, 42–44, 47, 48, 50, 53, 54, 57, 58, 61, 63, 71–78, 80, 81, 83–88, 94, 96.

Length of head 6·1, of tail 5·0, in the total; width of head, 1·4; interorbital space, 2·2, and equal to the length of the snout; width

of mouth 3·1, and length of pectoral 1·2, in the length of the head eye, 2·5 in the interorbital space.

Head depressed before, raised behind. Snout pointed in profile. Nostrils large, wholly below and not approaching the lateral margins, much nearer the mouth than the tip of the snout. Mouth small, obtusely angular; a long fold at the corner of the upper, and a short one on the lower, lip. Teeth small, smooth, arranged pavement-like in about thirty very oblique rows. Spiracle longitudinally oval, half the length of the pupil, its own length behind the eye. Nictitating membrane merely an extension of the lower eyelid, with scarcely trace of fold when drawn. The two posterior gill-openings above base of pectoral, the last one small.

Body compressed; a prominent ridge runs from the occiput to the upper base of the tail, and another along each side of the body. Shagreen very fine.

Fins.—First dorsal a little nearer the insertion of pectoral than to the ventral. Second dorsal smaller, its origin nearer caudal than hinder insertion of the first dorsal. Anal small, its origin beneath the middle of the base of the second dorsal and midway between the hinder insertion of the ventral and the caudal. Pectorals a little larger than the first dorsal; insertion of ventral nearer anal than pectorals. The length of the caudal equals the space between the two dorsals, and the length of its peduncle is 1·8 in its own length.

Colour, greyish blue above and white beneath; the coloured portion above with numerous very small white dots, which are close together, and evenly disposed along the lateral ridge.

Length of specimen described, 475 mm. (= $18\frac{3}{4}$ in.).

The smooth-hound is the smallest but at the same time by far the most numerous shark on the coast. It was taken, with but few exceptions, at all stations, and at depths ranging from 10 to 105 fathoms. It was not obtained at the Chatham Islands.

M. antarcticus agrees with the European *M. lævis* in having the embryo attached to the uterus by a placenta, a fact first noticed and described by Parker.* We obtained many young ones from the females, the largest number counted being eleven, six in one and five in the other uterus; they are similar to those previously described and figured by me. It may be noted that the peculiar form of the yolk-sac is retained until its complete absorption. In examples just prior to birth, the sac is like a small bean, the cord still entering towards one end.

In colour and general form the embryos bear some resemblance to those of *Galeus*, but may be at once distinguished by the smaller mouth, the position of the nostrils (removed from the margin of the head), the large second dorsal fin, and the simpler form of caudal.

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* Parker, Trans. N.Z. Inst., xv, 1883, p. 219.

Family SQUALIDÆ.

SQUALUS, Linnæus, 1758.

Squalus fernandinus Molina.

SPINY DOGFISH.

Plate XVI, fig. 1.

Squalis fernandinus Molina, Hist. Chil., 1788, p. 393.

Acanthias lebruni Vaill. Miss. Sci. Cap. Horn., Poiss., 1891, p. 13, pl. i, fig. 2.

(Not *Squalus acanthias* Linn.)

Stations 9, 11, 21, 32, 33, 36, 38, 43, 45–47, 50–53, 57, 59, 63, 88, 91, 92.

Length of head 5·8, tail 4·7, in the total length; width of head, 1·4; interorbital space, 2·3; snout, 1·9; width of mouth 2·2 in the length of the head. The pectoral fin is twice, and the eye one-half, the interorbital space.

Head depressed, snout long, the tip raised above the base line. Eye large, twice as long as deep, lateral, without nictitating membrane. Mouth scarcely bowed, a small labial fold at the corner of both upper and lower jaws, and an oblique groove on each side; teeth similar in both jaws, very oblique. Nostrils large, sub-inferior, midway between the mouth and the tip of the snout.

Spiracles large, lunate, on the upper surface of the head, behind but above the corner of the eye. Gill-openings subequal, in front of the pectoral; its anterior edge forms the hinder margin of the fifth gill-slit.

Body elongate, compressed. Shagreen rather coarse.

Fins.—The spine of the first dorsal fin is a little nearer to the tip of the snout than to the spine of the second fin. It is one-half the height of the fin, and much shorter than the second spine, which is nearly as high as its respective fin; the latter is much smaller than the anterior one. Anal fin absent. The pectorals are large, but shorter than the head; their origin is further from the snout than from the hinder insertion of the first dorsal. The origin of the ventrals is nearer to the end of the tail than to the tip of the snout. Caudal large with a single notch and a small pit above; peduncle broader than deep, with a low keel below the lateral line, which latter is well marked from head to tail.

Colour.—Purplish grey above, white beneath. When young the coloured portions are strikingly adorned with large white spots; these spots often persist in adult life, and the specimen above described and figured exhibits them conspicuously. These spots vary a little

in different individuals, but a pair in front of each dorsal fin and another pair behind the first dorsal seem to be very constant. A row of spots disposed in pairs is usually present along the lateral line, commencing between the spiracles; small irregular black spots are sometimes also present. In the young the tips of the first dorsal and the caudal are jet-black.

Length of specimen described, 512 mm. (= 20 in.).

Most of the adult females contained young, the highest number observed being seventeen. The following table shows the results of examination of eight individuals, including the number of young ones in each uterus.

A. 9 + 8 = 17.	E. 8 + 7 = 15.
B. 8 + 8 = 16.	F. 7 + 7 = 14.
C. 8 + 8 = 16.	G. 6 + 5 = 11.
D. 8 + 7 = 15.	H. 5 + 3 = 8.

The young were obtained in various stages of development in different individuals. The largest fœtal specimens taken measure 232 mm. in length: they were just ripe for extrusion, as the yolk-sac was wholly absorbed.

The point of each dorsal spine is covered by a little knob, a provision referred to in my notice of *Squalus megalops*,* and previously recorded by Ball in examples of "*Acanthias vulgaris*" on the Irish coast.† Richardson's figure‡ of a fœtus fairly represents our examples, but the first spine is too long, and the protective knobs are not illustrated.

This species was obtained along the whole of the coast-line explored, and at depths ranging from 9 to 105 fathoms. It was not found at the Chatham Islands.

The New Zealand representative of the family has hitherto been identified with the Atlantic *S. acanthias* Linn. Writing on *S. fernandinus*, Mr. C. Tate Regan§ says that "Records of *S. acanthias* from New Zealand doubtless refer to this species"—a conclusion based on an examination of specimens from Tasmania. He distinguishes *S. fernandinus* as follows:—

"Very closely allied to *S. acanthias*, but with a shorter snout, the præoral length equal to or less than the distance from eye to first gill-opening, the præocular length equal to the distance from anterior edge of eye to spiracle (more in *S. acanthias*, except in young examples). Dorsal-fin spines higher, and spots on the body larger, than in *S. acanthias*."

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* Waite, Rec. Aust. Mus., iv, 1901, p. 34, pl. iv, fig. 2.
† Ball, Proc. Roy. Irish Acad., iii, 1847, p. 230.
‡ Richardson, Voy. Ereb. and Terr., Fishes, 1845, p. 44, pl. xxviii, fig. 1.
§ Regan, Ann. Mag. Nat. Hist. (8), ii, 1908, p. 46.

Family NARCACIONTIDÆ.

NARCACION, Walbaum, 1792.

Narcacion fairchildi Hutton.

NUMBFISH.

Plate XVII.

Torpedo fairchildi Hutton, Cat. Fish. N.Z., 1872, p. 83, pl. xii, fig. 134.
Torpedo fusca Parker, Trans. N.Z. Inst., xvi, 1884, p. 281, pl. xxii.

Stations 17, 46–49, 51, 57–60, 87, 95.

Disc rounded and very broad, one-sixth broader than long and 1·5 in the total length, its length 1·7 in the same. The eyes are a little nearer to each other than to the front edge of the disc. The spiracles are not fringed, are placed obliquely, and lie about an eye-diameter behind the orbits.

Breadth of mouth equal to its distance from front edge of disc; the teeth small, sharp, and similar in both jaws; inner nasal valves confluent into a quadrangular flap, wider than long.

The height of the first dorsal fin, measured from its origin to the tip, is exactly one-half more than the height of the second dorsal. The hinder edge of the first dorsal extends somewhat beyond that of the ventrals. In the male but a small portion of the ventrals are free from the claspers. Caudal large, truncate, its depth nearly one-half greater than its length. The vertebræ occupy a median position, and do not extend to the margin; the peduncle is wider than deep, and a prominent keel extends along its posterior portion.

Colour dark bluish-slate above, white beneath, without markings.

Length of specimen, 520 mm.

Knowing the tendency of the disc to assume and retain unnatural shape under the action of preservatives, I was careful to allow specimens to die in a vessel of ample dimensions, and several so treated present almost identical relative proportions.

The specimens entirely agree with the short description of *Torpedo fairchildi* supplied by Hutton, and after consideration of all features I incline to the opinion that *T. fusca* is not distinct. The form of the dorsal fin varies considerably in different examples. In some specimens the fin has a well-marked posterior angle projecting far beyond the hinder insertion of the fin, a feature common to many selachians; in other examples the fin is leaf-like, as figured by Parker. Apart from this, however, the phrase "first dorsals over the ventrals, with the posterior edges of both in a line" (*T. fairchildi*) is not antagonistic to the description of *T. fusca*: "The posterior end of the base of the pelvic fin is nearly opposite the middle of that of the first dorsal." In fact, both statements are quite applicable to our specimens. The next feature referred to by Parker is the relative size of the two dorsals. In *T. fusca* the "length of the first dorsal fin is to that of the second

as 13 is to 8." In *T. fairchildi* it is " about one and a half times the size of the second," or as 12 is to 8. The descriptions may be regarded as identical in this respect.

As before indicated, too much reliance cannot be placed on the form of the disc, though the respective figures show great differences in this respect. My specimens are intermediate. The anterior emarginations in the disc referred to by Parker may be traced in my examples, also those figured by Hutton; but in neither case are they so pronounced as illustrated.

One example was trawled off Otago Heads in deep water (55–102 fathoms). The species was rather freely taken northward of Banks Peninsula, at a minimum depth of 18 fathoms; again in Cook Strait, in Poverty Bay, and finally in the Bay of Plenty. The " Doto " obtained " *Torpedo fairchildi* " in the Hauraki Gulf.

In my list of the Fishes of New Zealand* I used *Narcacion* Walbaum, 1792, as the name of the genus. In acknowledging a copy of the paper Mr. C. Tate Regan wrote, " If you reject *Narcacion* (as I intend doing), *Torpedo* is the correct name, as Gill's application of that name to *Malapterurus* is based on a misreading." In respect to this subject Dr. Jordan wrote, " As to Gill's use of *Torpedo*, Gill does not often make mistakes in matters of this kind. The only point against it, if I read Forskal's Latin aright, is that he uses only the oblique case, ' Torpedine,' instead of ' Torpedo.' "

Gill's papers on the subject are as follows: Proc. U.S. Nat. Mus., xviii, 1896, p. 162; and xxvi, 1903, p. 697. In the former paper the following passage occurs: " If the propriety of the retention of the name *Torpedo* in place of *Malapterurus* is conceded [and this is, of course, the crux of the discussion], it necessarily follows that another name must be used for the genus of electric rays. *Narcacion* is the oldest term, having been given by Klein in 1842 . . . . . but, having been given before the establishment of the binomial system of nomenclature, is now considered ineligible. The next in order of proposition is *Narcobatus*, introduced by De Blainville in 1816, and this should accordingly be adopted."

The use of Klein's names by Walbaum, in 1792, has not generally been recognised; *Narcacion* for the electric rays is one of these, and, as it antedates Blainville's *Narcobatus*, I consider that it should, apart from discussion of *Malapterurus*, be used to designate the genus. The question of Walbaum's names is one which might well be considered by the International Zoological Congress, and an authoritative decision would be not only approved, but welcomed by all concerned. The following quotation from an article by Dr. Jordan† is, though non-committal, suggestive :—

" Klein (about 1744) defined a large number of genera of fishes. In a post-Linnæan compilation of Walbaum (' Artedi Piscium,' 1792)

* Waite, *antea*, p. 8. † Jordan, Science, xxii, 1905, p. 491.

the diagnoses of all these pre-Linnæan genera are reprinted, although without formal adoption, into the binomial system. These genera are mononomially defined, at a later date than 1758, and there is no doubt as to the species intended to be included in them. If these names had been original with Walbaum, they would be accepted without question. What is their status as reprints in a compilation ? "

TYPHLONARKE, gen. nov.

Disc subcircular, its outline broken only by a notch under the tail. Eyes not discernible. Spiracles with entire edges. Tail short, with a slight lateral fold. Dorsal fin single. Anterior portion of ventrals modified for walking ; posterior portion coalesced with the pectorals to form the hinder margin of the disc. Teeth confined to anterior portion of jaws, pavement-like, the hinder series with sharp cusps. Body naked.

This genus differs from *Narke* in the form of the disc, in the coalescence of the disc with the ventrals, in the absence of functional eyes, and in the shortness of the tail.

Benthobatis moresbyi Alcock,* a blind electric ray, was taken off the coast of Travancore (Southern India), at a depth of 430 fathoms. It is interesting to note that *Typhlonarke aysoni*, also blind, inhabits comparatively shallow water.

Typhlonarke aysoni Hamilton.

BLIND NUMBFISH.

Plate XVIII.

Astrape aysoni Hamilton, Trans. N.Z. Inst., xxxiv, 1902, p. 224, pls. x–xii.

Stations 2–5, 7, 8, 17, 18.

Disc almost circular, the continuity of its margin being broken only by a slight notch under the tail. The position of the eyes is indicated by a minute white spot a little distance in front of each spiracle ; beneath the skin an optic nerve may be traced, but I fail to find any other sign of an eye. The spiracles are well developed, the space between them being one-third their distance from the front of the disc. Mouth narrow, protractile, in a fold of skin ; lips extremely fleshy, the upper one divided in the mid-line by an apparent space ; the lower lip is very deep, but the sides of the median fissure are close together, and each forms a ridge where they approximate. The nostrils are close together, and are covered by a common subquadrangular valve. Gill-slits in subparallel series. The teeth form a small pavement-like plate confined to the front of each jaw ; the posterior angle of each tooth is produced, slightly on the anterior series, and increasingly so backwards until in the hinder teeth a sharp cusp is developed.

* Alcock, Ann. Mag. Nat. Hist., (7), ii, 1898, p. 145.

The ventral fins are peculiarly modified. They have a very forward position, the distance from the front margin of the disc to their anterior insertion, in relation to that between the latter point and the hinder edge of the disc, being as 3 is to 2. They are widely separated, the space between their anterior bases being more than that between the series of gill-slits. They are normally directed almost at right angles, horizontally, to the axis of the body, and their front margins and their rounded extremities are covered with thick skin; they are attached posteriorly far within the margin of the disc, to which they are so completely coalesced that a slight notch on the hinder edge of the disc is the only external evidence of their position and extent. The horizontal length of each fin is equal to their distance apart. The claspers of the male are small; they do not reach the hinder edge of the disc, and they are free from it for about half their exposed length. The single dorsal fin arises anterior to the hinder edge of the disc; its length is one-fifth greater than its base, the latter being equal to the space between the outer margins of the spiracles. The tail is short, its length being 2·3 in the total; the caudal is rounded, its depth 1·3 in its length, or about the length of the snout; the vertebræ directed as in *Narcacion*, before described. Under the dorsal fin the tail is depressed, but the free portion of the peduncle is compressed. A trace of lateral fold.

Colours.—Coffee-brown above, pale brown beneath, darker round the margin of the disc; the mouth-parts and the margins of the ventrals yellow.

Total length, 375 mm.; length of disc, 260 mm.

Of two examples originally obtained in 1900, one was taken in Foveaux Strait and the other off Otago Heads. These situations furnish the limits between which we trawled the species, the depths being 36–102 fathoms, and the bottom sandy.

Specimens were not obtained larger than that described, at which size they were fully adult and mature.

Many of the females contained young, eleven being the largest number obtained from an individual, there being six in one oviduct and five in the other. At birth, when the yolk-sac is fully absorbed, they are of relatively large size, being 93 mm. in length, or one-fourth that of the parent (fig. 2). Examples at a length of 78 mm. still exhibit external gill-filaments. At 50 mm. the disc is continuous round the snout. In specimens of 40 mm. the pectorals are quite free, the gill-slits and spiracles are laterally placed, and the ventrals are not joined to the pectorals (fig. 3). As the embryo grows from the elongate shark-like stage, and the disc is formed, it increases in relative width; but at birth (fig. 2) it has not quite assumed the circular shape eventually attained.

It may be noted that *Narke*, Kaup, 1826, should be used instead of *Astape*, Muller and Henle, 1837, as pointed out by Gill.*

* Gill, Proc. U.S. Nat. Mus., xviii, 1896, p. 163.

Family RAJIDÆ.

Raja, Linnæus, 1758.

Raja nasuta Müller and Henle.

Skate.

Plate XIX and XXI, fig. 2.

Raja nasuta Müller and Henle, Plagiostomen, 1838, p. 150.

Stations 1–3, 5, 7–10, 13–16, 18–23, 25, 28–35, 39–44, 46–52, 54, 57, 63, 65, 70–74, 76–78, 81, 86–89, 91, 94–96.

Snout, from tip to anterior margin of orbit, 3·37 in the length of the disc; head, 2·52 in the same. Interorbital space 3·7, width of mouth 2·0, in the length of snout.

Breadth of disc one-sixth greater than its length, its anterior margin undulated; snout moderately produced, pointed; exposed portion of eye half the interorbital (cartilaginous) space, a fimbriated membrane over the upper part of the pupil. Spiracle close behind the eye. Mouth small, undulated, the gape a little further from the tip of the snout than is the eye. Internasal space equal to the width of the mouth.

Teeth in thirty-six rows, with long sharp points in the male (in the female the front rows are tuberculate, the hinder ones spinous). Upper lip not free in the middle; nostrils not confluent with the mouth; quadrangular flap fringed at the hinder corners. Gill-slits small; if continued posteriorly the two series would meet in an acute angle.

The skin generally is smooth, but roughened patches occur at the tip of the snout, above the rostral cartilage and at the middle of the anterior margin of the disc; the upper surface of the tail is also rough. The supraorbital ridge bears three to five spines; one to two occur in the mid-line of the back some distance behind the eyes, and a median row on the tail, one spine being placed between the dorsal fins. The anterior half of the front margin of the disc below, and beneath the snout and rostral cartilage, are roughened.

The two dorsal fins are subequal, and are separated only by the spine; second dorsal and caudal joined. Angle of the pectoral slightly obtuse. A well-marked fold along each side of the tail.

Colour.—Brownish olive above, with white spots, disposed around dark-grey markings. The largest of the latter is oval in shape, as long as the space between the outer margins of the eyes, and lies midway between the mid-line and the angle of the pectoral on each side. Another, much smaller, is placed in front and one behind. Still smaller markings occur round the margin of the disc, and dark-grey spots are elsewhere disposed—a double series forms bands along the back and tail. Snout and margin of disc reddish; under-surface yellow, clouded with grey about the snout and mouth; the posterior margin of the disc is grey, and there is also a broad band well within

this; the mid-line of the tail beneath is also clouded. The orifices of numerous pores are black, forming dots.

A colour variety of this species was taken at Station 89. It is bright olive-green above, with brownish-grey markings in the form of subcircular spots about the size of the eye. They are of fairly uniform dimensions, and there is no trace of white spots, nor of the large oval markings characteristic of the normal form.

This variety is illustrated on the accompanying plate, and, though the dark spots are not only conspicuous but striking, they have apparently the same actinic value as the ground; they consequently do not appear on the negative, an ordinary plate uncorrected for colour-values.

Length of specimen described, a young male, 500 mm. I measured examples up to 1,670 mm. Embryos, in two stages, are illustrated on Plate XIX, figs. 2 and 3.

Mr. H. Nielson, engineer of the Government steamer "Hinemoa," has kindly given me a photograph of a female skate which measured $7\frac{1}{4}$ ft. in length (2,530 mm.). It was taken in Anita Bay, Milford Sound, and two eggs enclosed in their cases were removed from the body. Crayfishes were found in the stomach.

The armature of the adult differs from the young, as usual with members of the genus. A stuffed specimen in the Museum obtained at the Chatham Islands presents the following dermal characters: The roughened areas in the young become distinctly spinous, and are somewhat extended. A broad spine-bearing band extends from the snout to the tail. The median and posterior part of each pectoral is smooth. Four rows of large inwardly directed spikes occur within the angle of each pectoral. The tail, in addition to the median row of spikes, bears a row on each side also.

At Station 22 an example was obtained minus the snout. The tissues had so overgrown the parts left by what was probably an accident that, apart from the peculiarity, there was no suggestion of abnormality.

Eggs were taken at Stations 7, 15, 16, 18, 22, 26, 29, 31, 32, 48, and 50, in the South Island, and at 70, Chatham Islands, but a single one only was trawled off the North Island (at Station 84), though skates were freely obtained.

The egg-cases are of the usual quadrangular shape, with a pair of long "horns" in front, and a shorter, thicker pair behind. One side of the case is convex, while the other is concave; the lateral edges are quite thin, but are bent over towards the concave side, which, naturally, becomes the lower surface when the case is placed on the ground. (Plate XXI fig. 2).

In the egg-case of *Cephaloscyllium* the spiraculæ are, as already described, longitudinal slits. In that of *Raja nasuta* the orifices are at the extremities of two tubes running on the inner edge of the anterior "horns," and opening at about the middle of their length. The

hinder " horns " are bent inwards, and the openings of the posterior tubes appear to be at or near their extremities.

The egg-cases vary considerably in size and proportion. The following table shows the dimensions of some examples, the " body " being measured irrespective of the " horns."

——	(*a.*)	(*b.*)	(*c.*)	(*d.*)	(*e.*)	(*f.*)	(*g.*)	(*h.*)
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Length	149	144	137	132	129	124	118	97
Breadth	66	86	80	76	78	77	65	59

The mean dimensions of twenty-nine examples are—length, 132·5; breadth, 77·6 mm.

The skate is common along the whole of the east coast, and was also taken at the Chatham Islands. It occurred at all depths between the extremes of 9 and 105 fathoms.

ARHYNCHOBATIS, gen. nov.

No cartilaginous rostral prolongation of the cranium. The pectorals continuous in front, but modified to form a small nasal tip. Ventrals distinct from pectorals, and deeply notched. Tail long, depressed, with well-developed caudal fin, and a fold on each side. A single dorsal fin, near extremity of tail. Each nostril with two valves, the anterior tube-like, the posterior triangular, the latter pair joined medially.

This genus appears to be allied to *Psammobatis*, Günther,* the absence of a cartilaginous rostral, and the character of the nasal valves, pointing to such connection. It differs in having a distinct caudal and but one dorsal fin.

If, as suggested, the genus is associated with *Psammobatis*, it forms another link in the chain connecting the faunas of New Zealand and South America.

Arhynchobatis asperrimus, sp. nov.

LONG-TAILED SKATE.

Plate XX.

Station 89.

Preorbital length (or snout) 4·27, length of head 3·08, in that of the disc. Interorbital space slightly concave, 3·3, and width of mouth 1·3, in the length of the snout.

The breadth of the disc is one-eighth greater than its length, its anterior angle is very obtuse, and the tip of the snout just breaks the

* Günther, Cat. Fish. Brit. Mus., viii, 1870, p. 470.

margin. The eye is 1·4 in the interorbital space. Spiracle close behind the eye, the posterior edge of the valve pilose. Mouth moderate, but slightly undulated; internasal space less than the width of the mouth. Teeth small, without cusps. Nasal flap triangular, but so deeply notched in the middle that two triangles are formed, each slightly fimbriated at the apex. Gill-slits moderate, convergent posteriorly.

The skin above is everywhere covered with closely set spines; thorns are developed in the area between the eyes and spiracles, the posterior ones being largest. A transverse patch of large thorns exists on the humeral region, whence a median row runs forward for a short distance. The tail carries a row of strong conical thorns in the midline, and several irregular series of smaller ones on each side; these extend forward into the pelvic region. No spine between dorsal and caudal. The whole of the body and tail below smooth and without pores.

The ventrals are quite distinct from the pectorals, and extend posterior to them; they are deeply notched behind, each being separately attached to the lower side of the tail. The distance of the vent from the hinder edge of the ventrals is one-fourth that between this point and the mouth. The tail is long, its length posterior to the disc being exactly half the total length; there is a well-developed fold of skin along each side, and the caudal is relatively large, its length above being twice the interorbital space. The dorsal lies near the caudal, but is removed from it by a space nearly equal to its own base.

Colour.—The colour above is uniform pale purplish-grey, and below deep yellow.

Length of female described, 640 mm.

The only specimen taken was trawled in the Bay of Plenty, at a depth of 66–94 fathoms.

Family DASYBATIDÆ.

DASYBATUS, Walbaum, 1792.

Dasybatus brevicaudatus Hutton.

STING-RAY.

Plate XXII.

Trygon thalassia Hutton, Cat. Fish. N.Z., 1872, p. 85 (not Columna).

Trygon brevicaudata Hutton, Ann. Mag. Nat. Hist. (4), xvi, 1875, p. 317; and Trans. N.Z. Inst., viii, 1876, p. 216.

Dasybatis brevicaudatus Hutton, Index Faunæ N.Z., 1904, p. 53.

Stations 85, 93, 94.

An example preserved for future study was unfortunately lost overboard during heavy weather; I therefore had to fall back upon

one in which nearly the whole of the tail had been lost. Though imperfect, some details not previously published may be gleaned from an examination of the specimen—a female.

Disc broader than long, widest at the first third of its length, anterior edge very obtuse, tip of snout scarcely indicated. Body entirely smooth.

Nostrils very large, widely separated, the width of the nasal fold nearly thrice its depth; lower lip papillose. Three processes behind the lower teeth, the median one being advanced. Two membranous flaps behind the upper teeth, extending along their entire width, the anterior one fimbriate, the other fleshy.

Each tooth with a shallow transverse groove; there are twenty-five series in each jaw, arranged quincuncially.

Colour.—Slaty-grey above, front margin of disc narrowly bordered with white and a dark zone within. An irregular series of white spots along each side, between the mid-line and the margins, in the thoracic region, and two white spots on each side in the lumbar region. White beneath, the area near the margins of the disc mottled with pink; minute black spots in the space between the mouth and gill-openings.

Length of disc, 800 mm.; width, 780 mm.

The type of the species, also a female, is described as being smooth with a small oval tubercle in the centre of the back. There is no cutaneous expansion above the tail, a feature characteristic of the subgenus *Hemitrygon*.

Of the three examples obtained, one was taken off Table Cape, north of Hawke Bay, in 42 fathoms; the other two in the Bay of Plenty, in 34–55 fathoms. The stomachs contained crustaceans which Dr. Chilton has identified as *Lysiosquilla*.

MYLIOBATIS, Duméril, 1817.

Myliobatis tenuicaudatus Hector.

EAGLE-RAY.

Plate XXIII.

Myliobatis tenuicaudatus Hector, Trans. N.Z. Inst., ix, 1877, p. 468, pl. x.

Aetobatus tenuicaudatus Gill, Mem. Nat. Acad. Sci., vi, 1893, p. iii.

Stations 86, 87, 91, 92, 94, 95, 96.

Body smooth.

Width of disc more than one and a half times its length, posterior angles acutely pointed. Eye 6·3, and interorbital space 1·3, in the length of the head. Spiracle twice the diameter of the eye. Nostrils close together, separated by a thick columnar frenum; nasal fold long and rectangular, its hinder border concave and papillose, widest at its free margin, where it is twice its length. Teeth in pavement-like

plates, the upper ones flat, the lower curved, all yellow in colour. Both plates are formed of two series, a median broad row and two lateral ones, the latter composed of rows of subcircular plates, three in width, and together about half the width of the median series; they do not extend to the front of the mouth. The upper median series are eleven in number, and the lower series seven. Dorsal fin small, its base one-sixth less than the spiracle. It is situated on the tail, its middle being over the hinder edge of the ventrals. Two serrated spines on the tail behind the fin. Tail a little shorter than the disc.

Colour.—Yellowish olive above, with blue transverse bars on the head and across the disc; lower surfaces white; tail black.

Total length, inclusive of tail, 775 mm.

Length of disc, 407 mm.; width, 661 mm. The specimen described is a male—and, though a dozen or more individuals were netted, only one female was obtained. No examples were taken southward of Hawke Bay, and, indeed, specimens were obtained only off Poverty Bay and in the Bay of Plenty, the depths ranging from 16 to 57 fathoms, with sandy or muddy bottom. Remains of molluscs were generally found in the stomach.

The generally accepted idea that the pectoral fins are interrupted, and reappear as cephalic fins in front of the snout, is recently stated by Mr. Regan to be incorrect. He says that the pectoral fins in *Myliobatis* and allied genera are continuous, but are very muscular, and have the anterior edge emarginate.*

HOLOCEPHALI.

Family CHIMÆRIDÆ.

CALLORHYNCHUS, Cuvier, 1817.

Callorhynchus callorynchus Linnæus.

ELEPHANT-FISH.

Plate XVI, fig. 2.

Chimœra callorynchus Linnæus, Syst. Nat., ed. x, 1758, p. 236.

Stations 2, 3, 8–18, 20–23, 27–29, 32–36, 39–48, 51–54, 57, 59–62, 72–74.

Length of head, 4·2; height of body, 5·0 in the length, measured to the base of the caudal lobe, and exclusive of the nasal appendage; the length of the latter is more than twice, and the retrorse foliate extremity is thrice, the diameter of the eye; the width of its distal half is more than an eye-diameter, and its termination is rounded and slightly notched. The eye is situated in the middle length of the head, and is contained 6·3 times therein. The dorsal fin arises above

* Regan, Proc. Zool. Soc., 1906, p. 757.

the isthmus, and its base, which can be received into a groove, is two-thirds that of the second; a low fold of skin runs from the first fin to within two eye-diameters of the second; the length of the spine is one-eighth longer than the head; it is acute and serrated in front, but flat or slightly concave behind, each posterior edge having in its upper half a series of retrose serrations; the rays are set on a high base, and the posterior ones are fairly distinct: the second fin is one-fourth lower than the first, and, following the high anterior lobe, falls gradually, terminating in advance of the anal: the length of the pectoral, exclusive of its base, is one-fourth that of the head, and it extends almost to the second dorsal; the ventral is inserted wholly in advance of that fin, and its length is 1·5 in the head; the anal lies directly in advance of the caudal lobe, and is long and narrow, its width one-third its length, which is 1·8 in the head; the caudal is deeply rayed below anteriorly, and the rays are continued to the end of the filament; there is a slight ray on the upper portion also; the upper insertion of the caudal is above the middle of the anal fin; the lateral line, posterior to the head, runs a direct though wavy course to above the caudal lobe, where it dips suddenly to the lower margin, thence to the end of the fin.

Teeth.—It would appear that the teeth undergo some change during the life of the animal, but I am not at present in a position to discuss the matter at length. The following references are to Garman's figures of the teeth of Chimæroids.* Young specimens exhibit teeth like *C. smythii* (vi, 1, 2), the vomerines forming a transverse cutting-edge; the palatines bear two pairs of ridges, of which the inner pair is the longer; there are two ridges on the mandibular plate, which operate between those of the palatines. In older specimens the palatine ridges are less pronounced, and the mandibular ridges disappear, the plate being flattened and incised anteriorly; these resemble *C. callorynchus* (vii, 7, 8), though the vomerine teeth still present the acute aspect; the jaws of an evidently very large specimen in the collection appear more like *C. tritoris* (vi, 9), the vomerine teeth have not a transverse aspect, while there is no trace of palatine or mandibular ridges, and the latter are rounded and have the front margin entire, as in the figure.

Colour.—Greenish yellow with black markings disposed in three longitudinal series along each side, one along the back, another following the course of the lateral line, and a third below it, terminating at the ventral; in some examples the lines are complete, in others they are broken up into blotches, and may be almost absent; the markings on the fins vary greatly also.

Bashford Dean has supplied a list of existing Chimæroids,† but the uncertainty there expressed shows that much yet requires to be

* Garman, Bull. Mus. Comp. Zool., xli, 1904, p. 245, pl. vi, vii.

† Dean, Carnegie Inst. Wash. Pub. 32, 1906, pp. 6, 7.

done before our knowledge of the species and relationship of the Order is satisfactory.

The elephant-fish was taken generally along the whole of the east coast of the South Island, but was not obtained to the northward of Cook Strait, nor did it occur at the Chatham Islands. In depth it ranged from 9 to 102 fathoms. The egg was obtained once only, an empty case being trawled at Station 31, in 21–24 fathoms, on a sandy bottom. The empty egg-cases are quite familiar objects to visitors to New Brighton, a marine suburb of Christchurch, for at certain seasons they are cast on to the beach in hundreds. It is extremely rare to find an embryo, though occasionally a living egg is thrown up among the spent cases.

The stomachs of the elephant-fishes examined, yielded examples of pipefishes, molluscs, and crustaceans.

EXPLANATION OF PLATES.

Plate XIII.

Eptatretus cirrhatus Forster.

Fig. 1. Adult, one-fourth natural size, exhibiting bite-scars on hinder half of body.

Fig. 2. Head, with tongue everted showing lingual teeth; slightly enlarged.

Fig. 3. Portion of body showing bite-scar; slightly enlarged.

Plate XIV.

Fig. 1. *Cephaloscyllium laticeps* Duméril. Female; one-sixth natural size.

Fig. 2. *Mustelus antarcticus* Günther. Female; three-eighths natural size.

Plate XV.

Galeus australis Macleay. Thirty-four young, removed from the body of one female; one-fifth natural size.

Plate XVI.

Fig. 1. *Squalus fernandinus* Molina. Male; one-fourth natural size.

Fig. 2. *Callorhynchus callorynchus* Linnæus. Female; one-fifth natural size.

Plate XVII.

Narcacion fairchildi Hutton. Male; about one-fourth natural size.

PLATE XVIII.

Typhlonarke aysoni Hamilton.

Fig. 1. Adult male; three-eighths natural size.

Fig. 2. Embryo, showing line of junction between the pectorals and the head; natural size.

Fig. 3. Younger embryo, in which the pectorals are free from the head; natural size.

PLATE XIX.

Raja nasuta Müller and Henle (variety).

Fig. 1. Young male; nearly one-third natural size.

Fig. 2. Embryo, showing rounded snout and long tail; natural size.

Fig. 3. Younger embryo, in which the tail is still longer relatively, and the pectorals are free from the head; natural size,

PLATE XX.

Arhynchobatis asperrimus Waite. Female; less than one-fourth natural size.

PLATE XXI.

Fig. 1. Egg-case of *Cephaloscyllium laticeps* Dumeril. (Note: A tendril at each end is represented as broken.)

Fig. 2. Egg-case of *Raja nasuta* Müller and Henle.

Both seven-ninths natural size.

PLATE XXII.

Dasybatus brevicaudatus Hutton. (Note: The tail is imperfect.)

Fig. 1. Upper surface.

Fig. 2. Lower surface.

Both one-eleventh natural size.

PLATE XXIII.

Myliobatis tenuicaudatus Hector. Male; less than one-fourth natural size.

JOHN MACKAY, Government Printer, Wellington.—1909.

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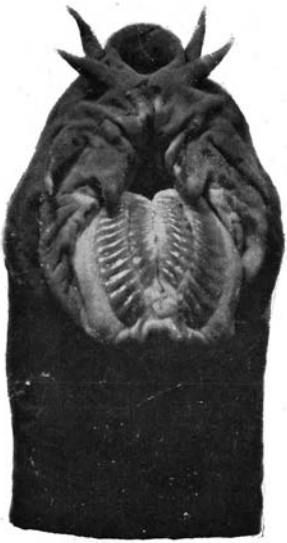

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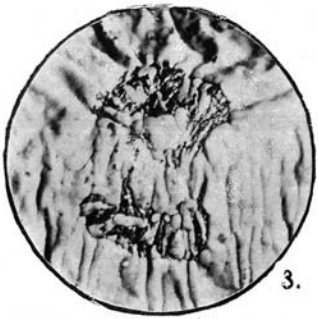

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[*R. Hülsen, photo.*

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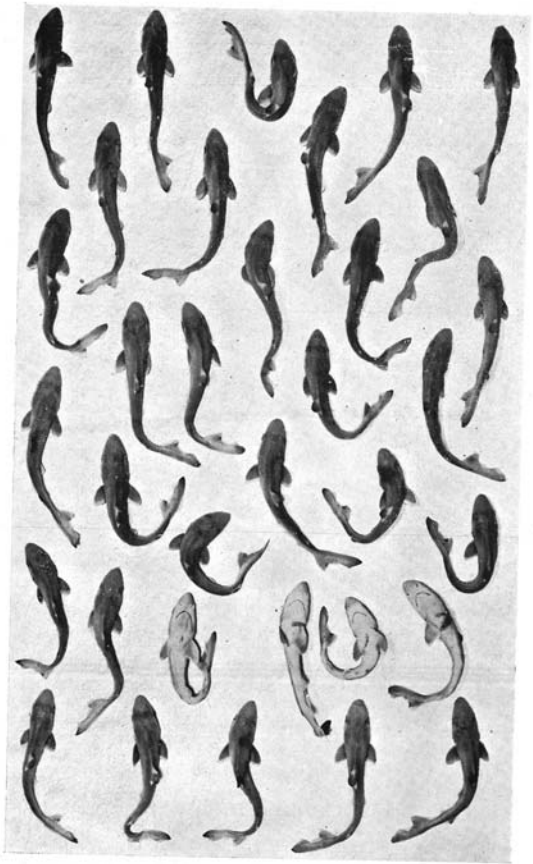

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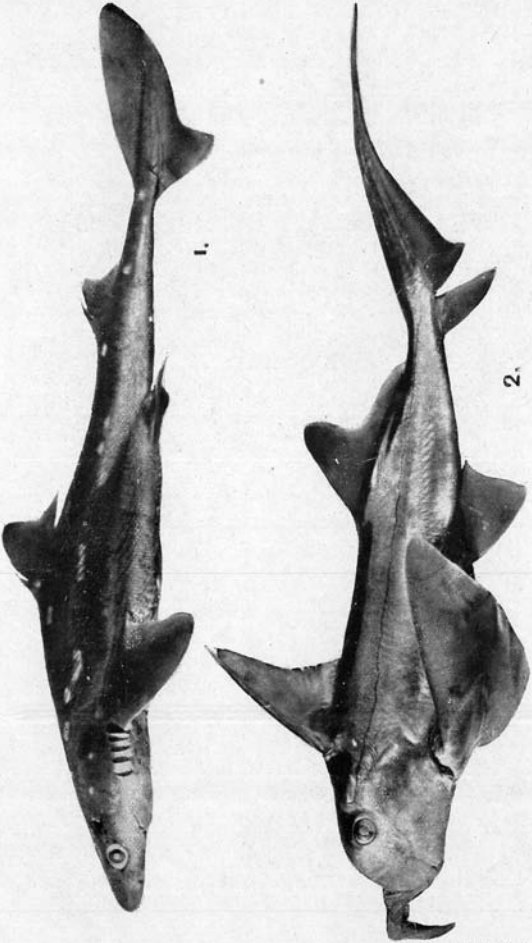
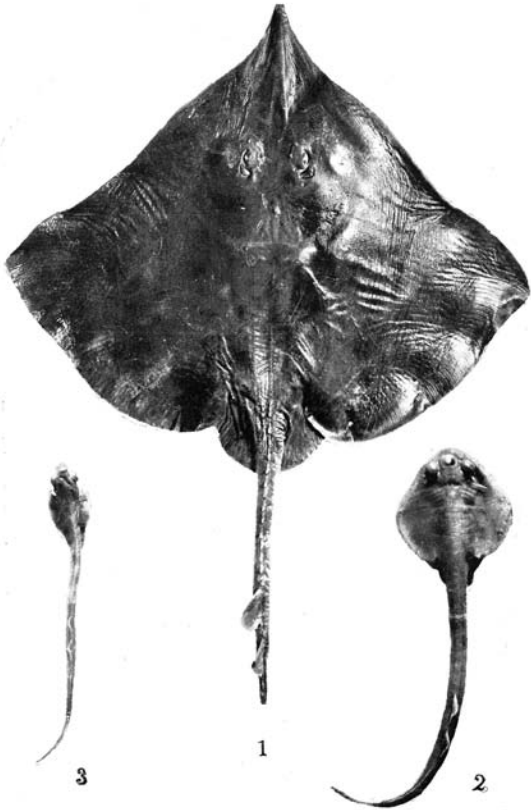


[R. Hillsen, photo.

[*W. J. Sparkes, photo.*

[*Edgar R. Waite, photo.*



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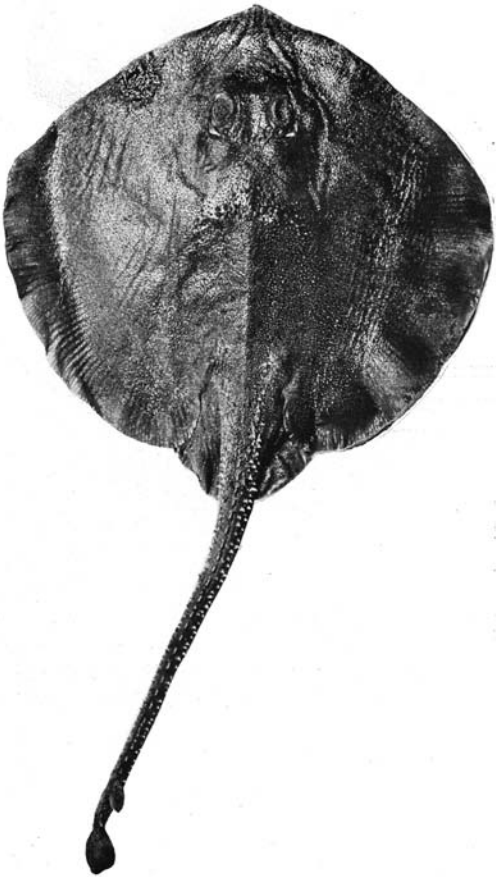
[*Edgar R. Waite, photo.*



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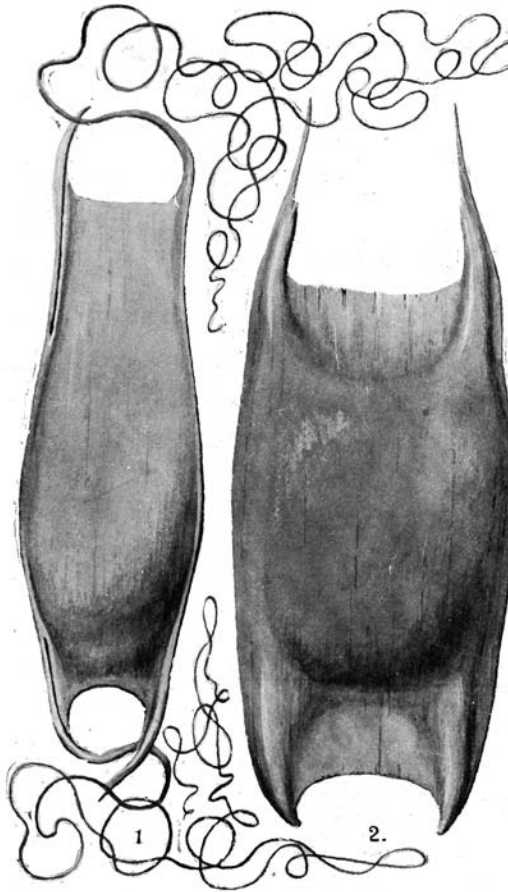

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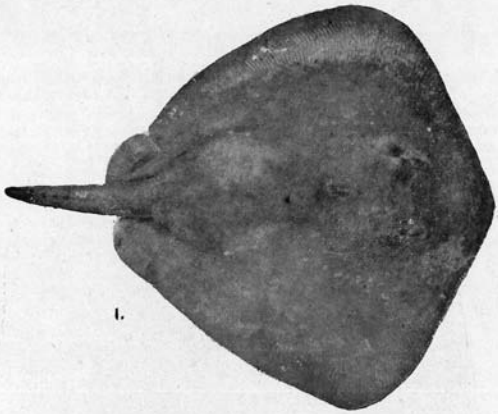

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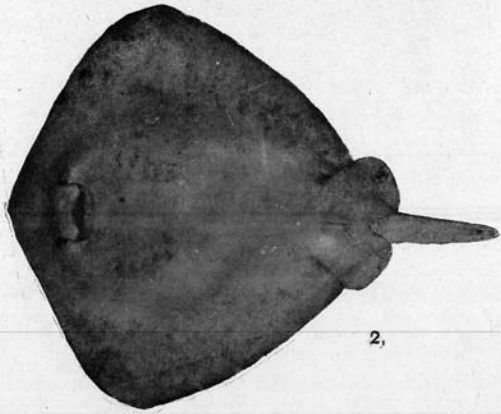

2.

[*W. J. Sparkes, photo.*

[*W. J. Sparkes, photo.*